BRITISH COLUMBIA UTILITIES COMMISSION

SITE C REPORT

IN THE MATTER OF
THE UTILITIES COMMISSION ACT
S.B.C. 1980, c.60 as Amended

AND

IN THE MATTER OF THE APPLICATION OF
BRITISH COLUMBIA HYDRO AND POWER AUTHORITY
FOR AN ENERGY PROJECT CERTIFICATE FOR THE
PEACE RIVER SITE C PROJECT

REPORT & RECOMMENDATIONS
to the
LIEUTENANT GOVERNOR-IN-COUNCIL

MAY 1983

BRITISH COLUMBIA UTILITIES COMMISSION

May 3, 1983

TO HIS HONOUR THE LIEUTENANT GOVERNOR IN COUNCIL

MAY IT PLEASE YOUR HONOUR

Under Your Honour's Order-in-Council Number 961 approved and ordered April 23, 1981, Your Honour appointed the undersigned and Mr. Robert A. Petrick, Mr. Lorne E. Ryan, and Mr. Earl E. Little temporary commissioners of the British Columbia Utilities Commission. We, together with Mr. Donald B. Kilpatrick, a member of the Commission, formed the Site C Division of the Commission charged with the responsibility of carrying out your order to "review the British Columbia Hydro and Power Authority's Application for an Energy Project Certificate for the Peace Site C Generation/Transmission Project."

This Order was accompanied by Terms of Reference dated the same day and signed jointly by the Minister of Energy, Mines and Petroleum Resources and the Minister of Environment. The Terms of Reference directed the Commission to submit a report and recommendations, with supporting rationale, to Your Honour on a number of issues.

The Commission has complied with your Order by reviewing B.C. Hydro's Application in accordance with the Terms of Reference.

We have the honour to submit herewith our report on the review.

Your humble and obedient servant

K A Henry

Keith A. Henry, P.Eng.
Chairman, Site C Division

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NOTES

1. References are made in the report to transcripts of the hearings and exhibits entered in evidence. The transcript references are shown thus: (100:16,485) indicating Transcript Volume 100, page 16,485. The exhibit references are shown thus: (Ex 37:20) indicating Exhibit 37, page 20. Any other references are fully self-explanatory.

2. There is a glossary of technical expressions at the end of the report.

3. Units and abbreviations are described at the end of the glossary.

4. Appendices to the report are bound separately.

5. The Site C Division's Report on the Review Procedures and Recommendations for Future Reviews is bound separately.

6. The Rationale and Criteria for Awarding of Costs in the Site C Review is Appendix 10.

7. For the convience of the reader, the Commission's report is summarized in Chapter I and the recommendations are collected in Chapter II. If there are any real or apparent discrepancies between these chapters and the main body of the report, the main body of the report is to be considered the authoritative version.

PART ONE SUMMARY AND RECOMMENDATIONS

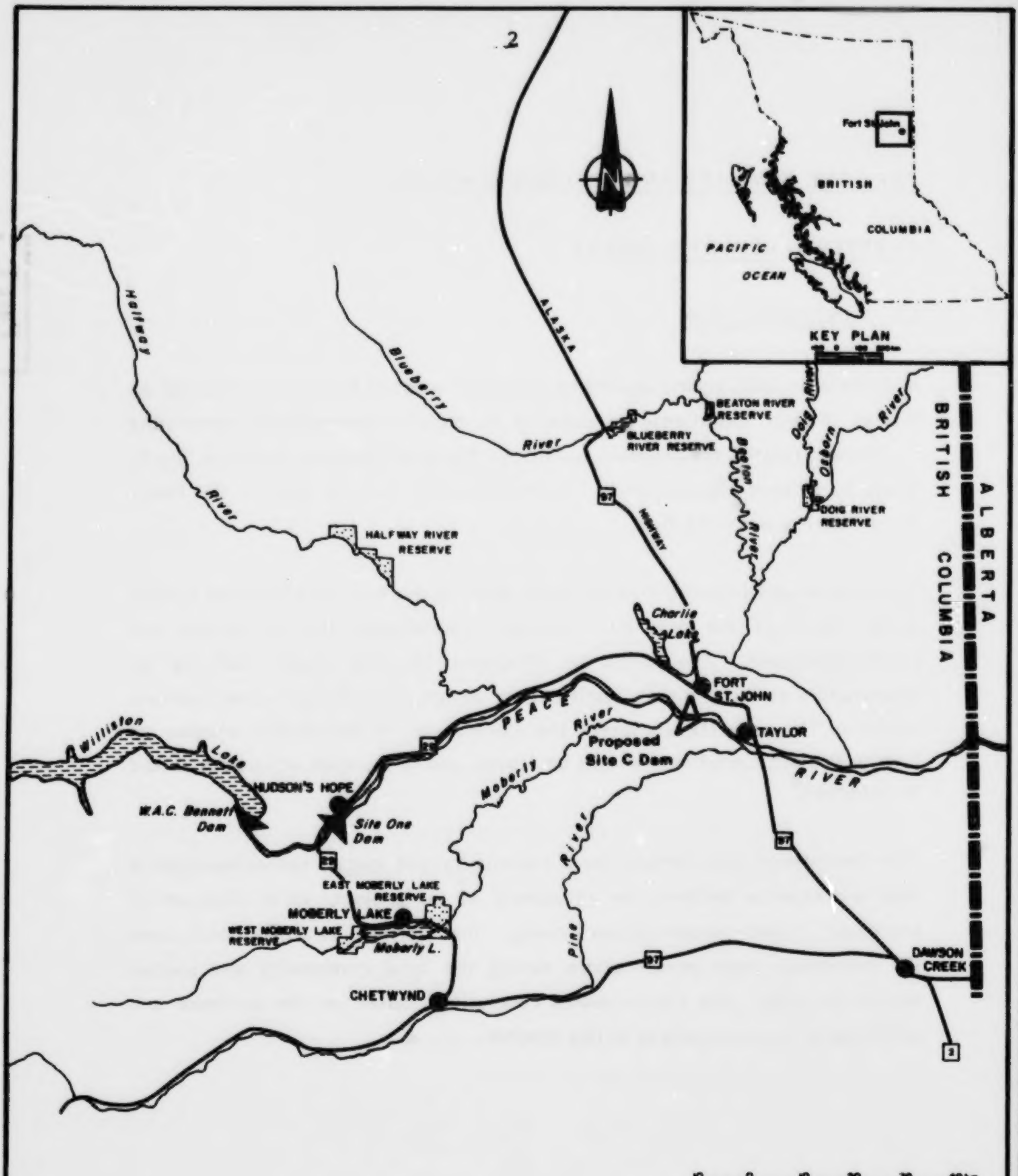
CHAPTER I - REPORT SUMMARY

1.0 INTRODUCTION

In September 1980, Hydro applied to the government of British Columbia for an Energy Project Certificate to allow it to build a hydroelectric generating station and related transmission facilities. The hydro station, known as Site C, would be located approximately 7 km southeast of Fort St. John on the Peace River (see Figures 1 and 2).

The government referred Hydro's application to the B.C. Utilities Commission under Part 2 of the new B.C. Utilities Commission Act for review and recommendations. The terms of reference for this review call for an examination of the project's justification, design, impacts and other relevant matters. They specifically direct the Commission to recommend whether an Energy Project Certificate should be issued, and if so, what conditions should be attached.

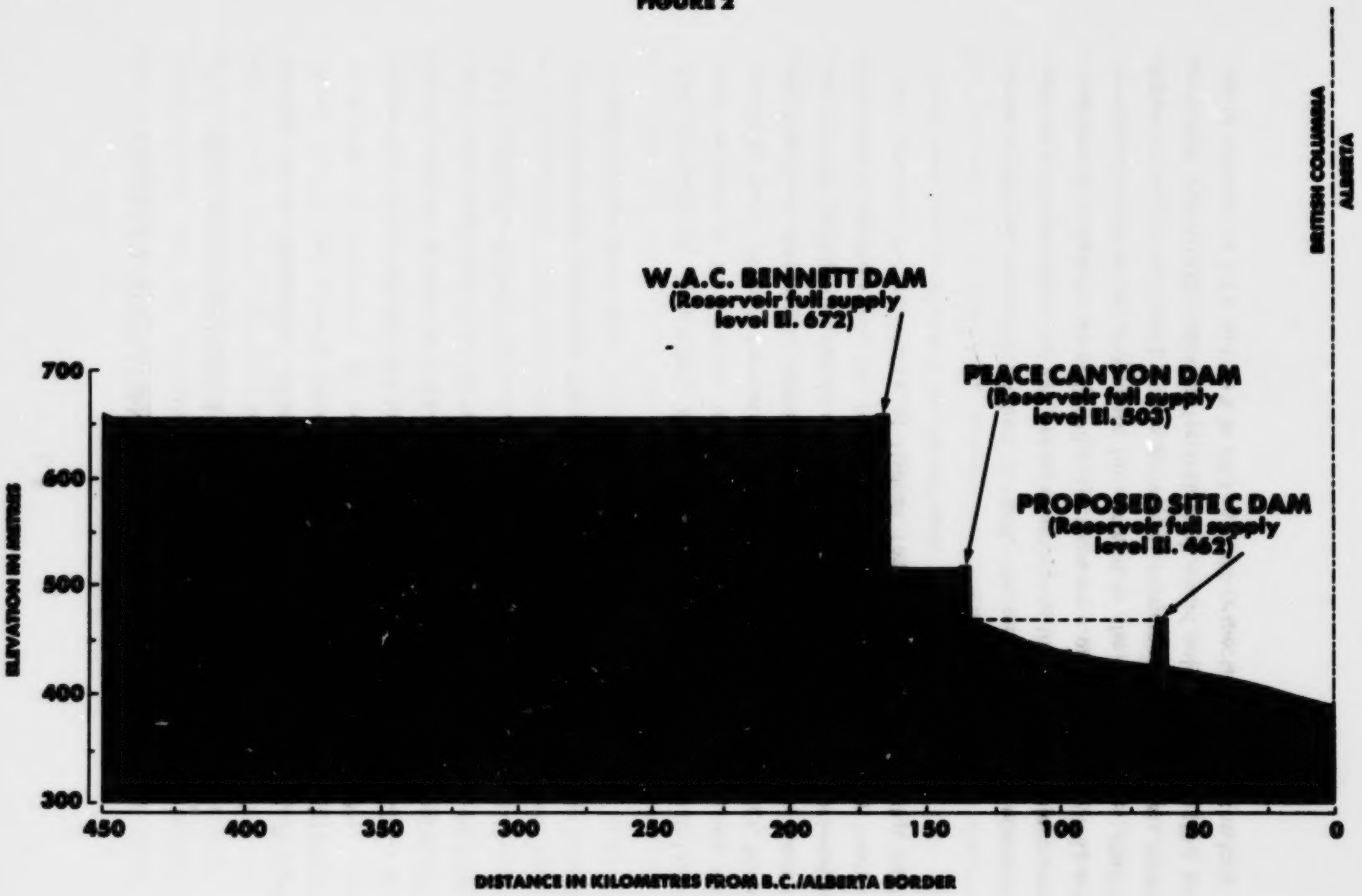
The Commission held formal, local community and special native hearings to hear and examine evidence on all aspects of the project. Over 70 panels of witnesses made presentations during the formal hearings and over 100 individuals made presentations during the local community and special native hearings. The Commission's conclusions, based on the evidence and submissions, are summarized in this chapter.



PLAN SHOWING THE SITE C REGION

FIGURE 1

FIGURE 2



PROFILE OF THE PEACE RIVER

2.0 PROJECT JUSTIFICATION

2.1 Electrical Energy Demand

Hydro's latest (September 1982) "probable" forecast of electricity demand shows Hydro's load growing from 32,359 GWh in its fiscal year 1981/1982 to 51,150 GWh by 1992/1993, an average annual growth rate of 4.3%. The September 1982 "low" forecast indicates an 11-year growth rate of 3.0% ; the "high" forecast a rate of 5.3%. This compares to Hydro's September 1981 "low", "probable" and "high" forecast growth rates (1980/81 to 1991/92) of 3.4%, 5.7% and 8.0% per year.

The Commission examined the methodology and underlying assumptions of Hydro's forecast in detail.

The Commission concludes that, while Hydro has made significant improvements in its forecast methodology, further improvements can and should be made. Hydro's forecasts, like those of the Ministry of Energy, Mines and Petroleum Resources, neither explicitly take energy prices into account nor rely on statistically significant past patterns of behaviour. Incorporating econometric methods into the forecasting process in a total energy context could improve the reliability of Hydro's forecasts, which, as Hydro itself noted, have been unreliable in the recent past.

Gross provincial domestic product (GPDP), the measure of total economic activity in the province, is a key variable underlying the forecast of electricity requirements. Hydro's latest GPDP projections were prepared in July 1982 and were predicated on an immediate turn-around in the U.S. economy, shortly followed by a turn-around in the provincial economy. On that basis Hydro projected that GPDP (adjusted for inflation) would only fall 2% in 1982 and would increase by 3.2% and 4.4% in 1983 and 1984 respectively. Over the long term, steady growth between 3.5% and 4.0% per year was expected. The Commission notes that Hydro's 1982 projection has now proven overly optimistic and the 1983 and 1984 projections may prove overly optimistic as well. The Commission concludes that, unless very high economic growth rates are realized in the late 1980's, Hydro's GPDP projections will be too high for the entire period.

In terms of specific industry outlooks, the Commission notes that Hydro's forecasts assume considerable expansion in all sectors, with major expansions in forestry, mining, petrochemical and other industries. Seven new chemi-thermal mechanical pulp mills are assumed to come onstream by the mid 1990's. All existing and newly constructed coal mines are assumed to be operating at full capacity by 1990. A liquefied natural gas plant, natural gas liquids extraction plant, an ethylene and derivatives plant, and an ammonia/urea plant are all assumed to be constructed by 1992. The Commission concludes that these forecasts describe the maximum potential outcomes rather than the most likely.

Hydro's evidence clearly indicates that electricity prices can be expected to rise in real terms over the next 10 years with particularly pronounced increases over the next five-year period. The Commission concludes that these increases are not fully reflected in Hydro's load forecast.

Hydro explicitly incorporated conservation allowances in its forecast, and attributed these allowances to price impacts. The Commission concludes that Hydro's treatment of conservation is inadequate and confusing. It is not clear how much of the allowances are due to appliance standards or regulatory measures, and how much are due to B.C. energy prices and conditions. The Commission notes that the conservation allowances are lower in Hydro's September 1982 than in its September 1981 forecast, even though higher real electricity prices are now forecast.

Hydro's forecasts assume technological shifts to more electricity-intensive industrial processes. This is most important in the forestry sector, where some 73% of the forecast growth in forestry electricity requirements is assumed to derive from electricity-intensive mechanical pulping. The Commission questions whether such shifts will take place as extensively or rapidly as Hydro has forecast in light of rising electricity prices and deferrals of new capital spending.

In forecasting the amount of electricity it will have to supply, Hydro deducted from its forecast of total electricity requirements the amount that will be supplied by industry itself. The Commission concludes that the potential for industry self-generation and co-generation is greater than Hydro has assumed, but whether that potential will be realized is unclear. In part, this will depend on whether various pricing and institutional impediments to self-generation are removed.

The Commission concludes that Hydro's demand forecast should be viewed as an upper limit to possible future electricity requirements and that for all of the foregoing reasons, a lower demand than Hydro has forecast in its "probable" case is likely.

The Commission reviewed demand in the export markets. The Commission concludes that markets do and will continue to exist in California where hydroelectric power can be used to displace oil and gas-fired thermal power generation. Because of Hydro's ability to store water and to time its sales to when intertie capacity is available, transmission constraints should not pose an insurmountable impediment to export sales destined for California. However, the value of these sales will depend on oil and gas prices and on the extent of electricity surpluses in other regions, both of which are likely to constrain export prices until the late 1980's. The market in the Pacific Northwest is less certain, depending on water conditions and future developments in both demand and supply in the region.

2.2 Electrical Energy Supply

On the basis of its September 1982 probable forecast Hydro indicated that a new energy source will be required by October 1990 to avoid shortfalls of firm supply. Hydro recommended Site C as the best feasible source of supply to meet the forecast requirements.

Hydro defines firm supply as the sum of its hydroelectric capability under critical water conditions, plus the energy capability of its Burrard thermal plant using gas supply available during off-peak periods, plus the energy available from firm purchase contracts. Hydro tries to time new facilities to ensure that probable demand does not exceed this firm supply.

The Commission notes that if better than critical water conditions prevail, if more than just off-peak gas could be made available to Burrard, if firm purchase or contingency planning agreements could be negotiated with neighbouring utilities or if new purchase contracts could be negotiated with industrial producers, the need for a new project could be significantly deferred.

With respect to water conditions, the Commission concludes that, while it is prudent to plan on the basis of a recurrence of a series of low-water years, Hydro should give high priority to investigating other ways of dealing with this possibility. One such method would be a planning agreement with Alberta whereby offpeak thermal power could be used to conserve water during low flow periods. Hydro officials cited this as a potential advantage of the Alberta Intertie line when it was proposed and reviewed.

With respect to the Burrard thermal plant, the Commission concludes that greater utilization of Burrard could defer the need for a new project by about one year. Policy direction from government on the value and marketability of natural gas and other matters is required in order to determine if greater use of Burrard is in the provincial interest.

In light of continuing uncertainties regarding both demand and supply, the Commission concludes that it is unclear when a new source of electrical energy will be needed. While Hydro's "probable" forecast and firm supply indicated a 1990 in-service date, its "low" forecast and any new arrangement that would increase its supply capability by 4,000 GWh per year would indicate a 1998 in-service date. The latter is only a possibility and is not necessarily the most likely, but it does indicate the wide range of uncertainty.

The Commission concludes, that because of this wide range, it is important to consider the consequences and costs of planning errors that result in overbuilding or undersupply. While the Commission recognizes that undersupply can impose serious consequences and should be avoided if at all possible, the Commission also recognizes that overbuilding imposes significant economic costs, particularly in light of the export market conditions currently forecast to prevail over the next decade. The Commission concludes that overbuilding should be avoided if possible, and that overbuilding could occur if a decision to build new generating capacity is made too soon. Given a realistic construction schedule of six years, the Commission concludes that construction of Site C does not need to begin any earlier than the spring of 1985.

In addition to the question of timing, the question of alternatives was considered in the assessment of the need for Site C. A wide range of conventional and nonconventional alternatives were addressed at the hearings.

The Commission concludes that the nonconventional alternatives cited at the hearings do not constitute viable alternatives to Site C; with the possible exception of geothermal power, they are too small and too expensive to have a major impact on supply in the foreseeable future. On the other hand, the Commission believes that there might be major conventional projects that could substitute, in whole or in part, for Site C.

When Hydro originally applied for Site C, it argued that Hat Creek was the only major alternative to Site C that could be built for the late 1980's. However, with the slippage in load growth predicted in Hydro's latest forecast, a late 1980's in-service date is no longer required, so the smaller alternative, Murphy Creek and Keenleyside, could be considered. Other projects could also become feasible alternatives if Hydro's load forecast continues to fall or if greater use of existing sources defers the need for new supply.

Hydro's benefit-cost justification of Site C was based on a comparison of the social costs of Hat Creek with those of Site C. Since Hat Creek is no longer an alternative, the Commission concludes that this benefit-cost test is not relevant. Such a test does not indicate whether a system expansion plan with Site C following Revelstoke is preferable from a social point of view to all other feasible expansion plans, given the current forecast of demand.

The Commission recognizes that Hydro would not construct Site C if it did not consider it to be the best feasible project. However, Hydro uses private corporate criteria to evaluate and select projects whereas the province recommends the use of social benefit-cost criteria, which takes into account all resource losses and the social value of capital and labour.

The Commission concludes it has not been adequately demonstrated that Site C is the best possible project from a provincial point of view. This matter requires further consideration.

2.3 Financial Impacts

As part of its justification for the project, Hydro indicated that the $3.2 billion financing requirement for Site C is feasible and that the rate impacts would be relatively small, peaking in the first full year of operation at a real increase of 6%. The Commission concludes that the financing of Site C is feasible and that the impacts on customer rates would be acceptable.

The Commission notes, however, that Hydro's financing abilities are predicated on the province's 100% guarantee of its borrowing. The Commission also notes that the regulatory environment in which Hydro operates could affect the availability and cost of capital. A prolonged shortfall in meeting its financial targets due to falling markets, operating inefficiencies or legislative and regulatory constraints would adversely affect Hydro's ability to raise capital.

The Commission concludes that, while the rate impacts of Site C could be moderate, they could become significantly larger if the project is built prematurely, if costs escalate or if real interest rates increase above the levels assumed by Hydro. The Commission is confident Hydro can manage its construction costs effectively. With regard to interest rates, the Commission notes that falling inflation rates may have the effect of increasing the real cost of money borrowed at locked-in rates. Opportunities for flexible financing (eg. better redemption provisions) are important in this regard. With regard to timing, the Commission concludes that underutilization would increase the rate impact. This possibility, particularly in the context of relatively poor export markets, is an important reason for the government and Hydro to guard against starting construction prematurely.

2.4 Commission's Position on Project Justification

The Commission does not believe that an Energy Project Certificate for Site C should be issued at this time. The evidence does not demonstrate that construction must or should start immediately or that Site C is the only or best feasible source of supply to follow Revelstoke in the system plan.

The Commission therefore concludes that an Energy Project Certificate for Site C should not be issued until (1) an acceptable forecast demonstrates that construction must begin immediately in order to avoid supply deficiencies and (2) a comparison of alternative feasible system plans demonstrates, from a social benefit-cost point of view, that Site C is the best project to meet the anticipated supply deficiency. These matters should be reviwed by Cabinet in the fall of 1984 as recommended in Chapter X.

3.0 PROJECT DESIGN AND SAFETY

Hydro presented a detailed preliminary design at the hearings. It indicated that this would evolve into a final design as the project progressed and would be subject to extensive internal and external checks to ensure its reliability.

Hydro testified that the designs of the dam, spillway and powerhouse were carried out according to sound engineering principles by a thoroughly experienced staff and reviewed by renowned experts. In the highly unlikely event that the dam failed, the failure would be gradual. The dam would not be over-topped by slide-induced waves in the reservoir. Hydro concluded that, under all foreseeable circumstances, downstream warning could be provided in time to avoid loss of life.

The Commission concludes that the design presented by Hydro for Site C is sound and reflects concern for public safety. The Commission further concludes that Hydro's system of internal and external checks ensures a safe design.

Hydro testified that reservoir bank stability was a matter of on-going concern and that it had conducted extensive studies to predict areas most susceptible to instability. In addition, it proposed a comprehensive monitoring program to be conducted after the reservoir is filled to identify dangerous or unstable areas. The only area in which Hydro predicted a problem with bank stability that might endanger existing structures was immediately east of the bedrock strata at Hudson's Hope for a distance of 1,300 meters. Hydro proposed to construct a protective berm in that area.

The Commission concludes that, as long as Hydro diligently conducts the monitoring program it has proposed, the problems of bank instability arising from filling the reservoir can be minimized.

Hydro estimated the total construction cost of the project would be $1.1 billion in constant 1981 dollars (excluding interest during construction). Hydro indicated it would take six construction seasons to build the project, and it would use a project management system of control during the construction phase.

The Commission concludes that, within an acceptable margin of error, Hydro can construct the Site C project in six years for a total of $1.1 billion and that Hydro is fully competent to manage the construction.

4.0 PROJECT IMPACTS

4.1 Land Use and Environmental Impact

The Site C project will result in the flooding of 4,600 ha of land between the dam site, 7 km southwest of Fort St. John, and the Site One dam, near Hudson's Hope. Another 1,400 ha of land will be affected as a result of construction and highway relocation activities and transmission line clearing between Site One, Site C and Fort St. John. Outside the immediate area, the proposed transmission line between Williston and Kelly Lake will affect 1,150 ha of land.

The Commission has attempted to assess the significance of these impacts in terms of their effect on all of the resource activities the area would otherwise have supported. The Commission's conclusions on each resource impact are as follows.

4.1.1 Climate and Agriculture

The Commission concludes that the project's impacts on climate are uncertain, but are likely to be relatively small and limited in extent. There could nonetheless be some impacts on climate in the immediate area of the reservoir from increased fog and humidity which might adversely affect farming in the region.

The principal impacts on agriculture would result from flooding and construction activities. The Commission concludes that almost 3,000 ha of potential agricultural land would be lost as a result of the project. The Commission estimates the social value of this land to be $59.8 million.[1] The social value of the agricultural losses on Crown land alone would be $18.6 million. The Commission recommends that compensation equal to the agricultural loss on Crown land be paid to the government and be used to fund agricultural programs in the region. The Commission recommends removal of the flood reserve below Site C to encourage further agricultural development in the region. A number of mitigation measures should be implemented in order to minimize adverse impacts of transmission line rights-of-way, construction and highway relocation.

Concern was expressed about the long-term implications of agricultural land losses in light of increasing world food demands. The Commission recognizes that the agricultural land that will be lost as a result of Site C is of high quality and cannot be replaced. However, the Commission concludes that agricultural productivity can and should be enhanced on the remaining lands and that the agricultural losses caused by Site C do not constitute an insurmountable obstacle to the project.

4.1.2 Forestry

The Commission concludes that flooding will result in the loss of approximately 1,700 ha of productive forestry land, causing a social loss of $1.0 million less the amount of stumpage Hydro pays in its clearing operations. In addition, losses will occur due to transmission line clearing. These forestry losses have not yet been quantified, but they should be before an Energy Project Certificate is issued. The Commission concludes that, while the forestry loss is relatively small, compensation should be paid and the funds used to enhance forestry in the region.

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[1] All values are reported in 1981 constant dollars. Resource losses have been calculated on the assumption of a 1985 issuance of an Energy Project Certificate and have been present valued to that date. A hybrid discounting procedure has been used for the calculations. Values for an 8% discount rate are shown in the main report.

In order to maximize potential recreation benefits from the reservoir the Commission recommends that Hydro remove all accessible timber below the full supply level elevation of 461.8 meters and all timber, whether readily accessible or not, extending above an elevation of 452 meters. Clearing standards will be set out by the Ministry of Forests, but the Commission recommends that the Ministry of Lands, Parks and Housing and the Ministry of Environment be consulted regarding appropriate specifications to protect wildlife and recreational resources.

4.1.3 General Outdoor Recreation

The Commission concludes that, while the project will create new reservoir recreational opportunities, these will not offset the quality and value of lost river-based recreation. The Commission estimates a net recreational resource loss of $6.9 million. The Commission concludes that compensation of this amount should be paid by Hydro to the government and that it should be used to enhance recreational resources in the region. The Commission recommends that the Ministry of Lands, Parks and Housing undertake the recreational enhancement programs, except for certain projects to be undertaken by the District of Hudson's Hope, the local River Rats Club and the Ministry of Environment. Recreational enhancement should be undertaken both on and off the reservoir.

4.1.4 Wildlife and Recreational Hunting

The Commission concludes that the flooding will result in significant loss of both game and non-game wildlife in the region. The potential for enhancement of these wildlife resources will also be lost. The Commission estimates the recreational hunting loss due to flooding at $2.8 million, and recommends that Hydro pay that amount in compensation and that the funds be used to enhance wildlife in the region. Losses from sources other than flooding should be identified and dealt with under the monitoring program that the Commission recommends be established for Site C.

4.1.5 Recreational Fishing

The reservoir will create lake-type habitat and fishing opportunities, but eliminate some river-based fishing. The net effect depends on the carrying capacity of the two types of habitat and the relative attractiveness of the fishing they offer. The Commission concludes that the evidence presented at the hearings on these fishing impacts was based on insufficient data and thus is inadequate for assessing losses. The Commission recommends that Hydro be required to undertake certain studies in consultation with the Ministry of Environment in order to provide a reasonable basis for assessing impacts and losses due to flooding and that this be a condition of an Energy Project Certificate. The Commission further concludes that, based on the results of these studies and the valuation assumptions established in this report, appropriate fisheries compensation should be determined.

4.1.6 Water Quality and Downstream Users

The Commission concludes that, while downstream water users, in particular, Westcoast Transmission Co. Ltd., might be affected, the exact nature and consequences of these effects cannot be determined at this time. The Commission recommends that Hydro, in consultation with Westcoast, institute a measurement program to identify the impacts. Compensation for any adverse impacts should be negotiated between Hydro and Westcoast.

4.1.7 Heritage Resources

The Peace River Valley is important for its heritage resources. While Hydro has already undertaken an extensive $600,000 heritage resource program, in the absence of further work, a considerable amount of archeological resources would be lost. The Commission concludes that the Heritage Resources Branch of the government should be responsible for the recovery of these resources. Hydro's responsiblity should be limited to paying the extra capital costs, less the $600,000 already spent, that would be incurred as a result of an intensive recovery program prior to flooding, as opposed to an attenuated program which could otherwise take place. On this basis the Commission concludes that Hydro should be required to pay $0.5 million as compensation, but only if matched or exceeded by funds raised through the Heritage Conservation Branch for the purpose of implementing the intensive recovery program.

4.1.8 Terrain and Mineral Resources

The Commission concludes that impacts on terrain and mineral resources would be minor. No evidence was presented that would justify imposing mitigation or compensation measures regarding them.

4.2 Regional Economic and Social Impact

Construction of Site C and related activity would require an estimated 5,400 man-years of work over a seven year period. The construction and the resulting influx of workers would have economic and social impacts on nearby urban, rural and native communities. These communities would also be affected by the project's environmental impacts.

4.2.1 Regional Economic Impacts

The employment and related spending generated by Site C will give rise to significant economic impacts, but the share accruing to regional residents would depend on the extent of local hiring. The Commission concludes that, under prevailing economic conditions in the northeast, local hiring could constitute the most significant compensation for adverse project impacts. If such economic circumstances continue, an aggressive training program to facilitate increased local participation in construction should be implemented. Cooperation among all concerned parties would be required for this to be successful.

From a provincial point of view, the benefits of the employment created by Site C will depend on the extent of unemployment at the time of construction. Similarly, the social costs associated with the layoffs at the end of construction will depend on employment opportunities that then prevail. The Commission concludes that project timing is important in both these respects, but does not recommend that project timing be determined by employment considerations.

4.2.2 Infrastructure and Financial Impacts on Local Governments

The Commission concludes that the City of Fort St. John will suffer increased administration costs and costs associated with providing additional water and sewage services. The Commission, however, does not endorse the compensation package proposed by Hydro and accepted by the City since the magnitude of the impacts cannot be determined at this time. The Commission therefore recommends that the identification of, and compensation for, financial impacts on Fort St. John be referred to the monitoring program.

The Commission recognizes the concerns that Hudson's Hope property owners have about bank stability. The Commission recommends that bedrock banks be monitored as directed by the Water Comptroller, that the monitoring reports be made public and that corrective measures be taken as required. For overburden banks, the Commission concurs with Hydro's proposals to construct a berm and to institute a monitoring program.

The Commission also recognizes that Hudson's Hope would suffer losses of land and properties, and recommends that compensation be paid in an amount equal to the net decline in property tax revenue plus the replacement or repair cost of affected municipal works and facilities.

Regarding impacts on the Peace-Liard Regional District, the Commission concludes that net revenue losses, if any occur, should be identified and dealt with under the monitoring program.

Regarding the Village of Taylor's claim to compensation for special design costs in its recently constructed water intake, the Commission agrees with Hydro that no compensation should be awarded because modifications were not required in anticipation of Site C.

4.2.3 Social Service Impacts

The Commission recognizes that health and other social service requirements will increase as a result of the project's construction, but the exact magnitude cannot be determined until the in-migration patterns of the construction labour force have been established. The Commission therefore concludes that the identification and compensation for social service impacts should be dealt with under the monitoring program.

4.2.4 Rural Community Impacts

The Commission believes that the impacts on the approximately 100 families in the Peace River Valley who will be directly affected by flooding constitute the most significant social impact of the project. The Commission concludes that these impacts cannot be mitigated to any significant degree. The Commission also further concludes that, while Hydro's land acquisition policy is essentially a private matter between it and the local landowners, Hydro should make every effort to be fair in the way it acquires additional land if Site C proceeds and in the way it disposes of land it does not ultimately require.

4.2.5 Native Community Impacts

The Commission notes that the native subsistence economy in the northeast is threatened by various developments in the region. The Commission considers the cumulative impact of development on the local native communities to be outside the terms of reference for these hearings, but does recommend that the appropriate Ministries of the federal and provincial governments carefully review and consider the evidence presented by the native witnesses and representatives.

With respect to the impacts of Site C, the Commission concludes that, while small on a provincial scale, they could be significant to the native population in the region. The Commission recommends that impacts on native communities be monitored. If adverse impacts on hunting are identified, the Commission recommends that measures to compensate in kind be implemented; monetary compensation will not suffice. The Commission recommends that the native people report any social impacts to the monitoring program with their suggestions for remedial measures.

4.3 Monitoring Program

The Commission has identified a number of social and environmental impacts that should be dealt with by a monitoring program. The Commission recommends that a monitoring program be established to identify and resolve these impacts as well as unanticipated impacts that arise during construction. The Commission recommends that the monitoring program also be used to verify compliance with the conditions imposed on the Energy Project Certificate.

The Commission concludes that a monitoring office in Fort St. John, headed by a monitoring commissioner with a small staff, is the most appropriate structure for such a program. The monitoring commissioner must have the authority to issue orders to Hydro, must have close liason with government

Ministries and agencies, and must be accessible to the public. The Commission recommends that the monitoring commissioner be appointed as a temporary or permanent member of the Utilities Commission. This would provide him with the necessary authority and would enable the Utilities Commission to review his orders on appeal. Funding for the monitoring program should be provided by Hydro.

5.0 OTHER APPROVALS AND OTHER MATTERS

5.1 Other Approvals

In addition to an Energy Project Certificate, Hydro requires approvals under the Water Act and the Waste Management Act before it can construct Site C. The Commission concludes that, at such time as the issuance of an Energy Project Certificate is warranted, approvals under these acts should also be granted. The Commission's specific recommendations with respect to a Water License are contained in Appendix 9. The Commission further recommends that when an Energy Project Certificate is issued, Cabinet take whatever steps are required under the Agricultural Land Commission Act to allow the project to proceed.

5.2 Other Matters

Under the Utilities Commission Act, a Certificate of Convenience and Neccesity is deemed to have been issued by the issuance of an Energy Project Certificate. The Commission concludes that, if and when the conditions related to project justification are satisfied, the project will indeed be in the public convenience and necessity.

The Commission concludes that a number of energy policy issues should be clarified in order to assist Hydro and future panels in developing and reviewing Hydro's projects and system plans. In particular, more explicit direction on energy pricing policy and industrial development policy should be provided. The Commission also concludes that the government should reconsider its policy with respect to electricity exports.

Several other policy matters were raised at the hearings. The Commission's views on them are contained in Chapter XX of this report.

CHAPTER TWO REPORT RECOMMENDATIONS

The Commission's recommendations are paraphrased in this chapter. The reader should refer to the text of the report at the indicated page numbers for the precise wording of the recommendatons.

1.0 PROJECT JUSTIFICATION

1.1 Forecasting Procedures

The Commission recommends that Hydro be directed to:

1. include econometric techniques in its long term load forecasting (p. 63);

2. develop its forecasts in a total energy context (p. 63);

3. improve its treatment of conservation (p. 78);

4. analyze relative fuel prices and policies in the context of a total energy forecast for purposes of estimating interfuel substitution (p. 80).

1.2 Electrical Energy Supply

The Commission recommends that Hydro be directed to:

5. investigate alternative methods of dealing with the possibility of critical water conditions in order to moderate its firm supply criteria; specifically, consider and pursue planning agreements with Alberta in this regard (p. 91, p. 93).

The Commission recommends that the Government:

6. provide specific policy direction to Hydro on the value of capital and natural gas from a provincial point of view in order to assist Hydro in determining the appropriate use of the Burrard Thermal Plant (p. 92);

7. consider whether institutional impediments (e.g. regarding purchase pricing, financial and wheeling policies) to the private development of non-conventional energy sources might be removed or lessened (p. 106);

8. advise Hydro of the evaluation criteria it should adopt in future planning and facility applications and resolve the present inconsistency between the private criteria Hydro uses to select and evaluate projects and the social criteria which the government has directed the Commission to use in evaluating Site C (p. 108).

1.3 Financial Impacts

The Commission recommends that in future applications Hydro:

9. provide data on the full rate impact to customers of the proposed project isolated from the impacts of the projects which may follows (p. 120);

10. provide data on the different patterns of rate impact that would result from the alternative system plans (p. 120).

1.4 Issuance of an Energy Project Certificate for Site C

The Commission recommends that Cabinet:

11. defer issuing an Energy Project Certificate for Site C until an acceptable load forecast demonstrates that construction of Site C must begin immediately in order to avoid supply deficiencies, and a compari-

son of alternative system plans demonstrates that Site C is the best project to meet the anticipated shortfalls (p. 126);

12. determine, in the fall of 1984, if the above two conditions are met, and either issue, further defer or reject the issuance of an Energy Project Certificate depending on the information available at that time (p. 126-7);

13. direct the B.C. Utilities Commission to hold public hearings at that time to assist it in making these determinations (p. 127).

2.0 PROJECT DESIGN

2.1 Reservoir Safety

The Commission recommends that as conditions of a water license for Site C Hydro be directed to:

14. make inspections of known potential slide areas as frequently as appropriate but at least once a year (p. 133);

15. annually inspect the reservoir perimeter to identify new slide areas (p. 133);

16. report on inspections to the Water Comptroller to give warning of any potential slides (p. 133);

17. maintain a constant monitoring program around the reservoir perimeter during flooding (p. 133);

18. monitor the stabilization of banks after flooding (p. 133);

19. differentiate between truly dangerous areas and those areas that can be used with safety by the posting of specific warning signs (p. 133);

2.2 Project Costs

The Commission recommends that prior to the future review of project justification Hydro be required to:

20. provide a detailed cost estimate following present day budget estimate practices (p. 140).

2.3 Adequacy of Design and Protection of Public Safety

The Commission recommends that upon issuance of a Energy Project Certificate the Comptroller of Water Rights be directed to:

21. issue a Water License with the terms as outlined in Appendix 9 of this report (p. 140);

22. monitor the design, construction and operation of Site C to ensure the reservoir is operated in the best possible manner (p. 140).

3.0 PROJECT IMPACTS

3.1 Land Use and Environmental Impacts

With respect to impacts on climate and agriculture the Commission recommends that as conditions of an Energy Project Certificate:

23. Hydro undertake the eight agricultural impact mitigation measures related to transmission line development and dam construction as oulined on page 171 of this report (p. 171);

24. Hydro fund and participate in the development of a land use plan and be subject to it (p. 171-2);

25. if the land use plan identifies areas where top soil removal is appropriate and cost effective, Hydro undertake this mitigation measure (p. 172);

26. Hydro be required to pay to the government $18.6 million (in constant 1981 dollars) as compensation for the loss of crown agricultural land due to the flooding; no compensation is recommended for social loss on privately held lands (p. 172).

The Commission further recommends that:

27. Cabinet remove the flood reserve below Site C to prevent futher agriculture resource loss in the region (p. 164);

28. compensation funds be dedicated to agricultural programs in the region developed by the Ministry of Agricultural and Food in consultation with a planning committee as recommended by the B.C. Federation of Agriculture (p. 172);

29. concerns about climatic impacts, such as increased fog effects on crop drying, be given high priority when developing agricultural compensation programs for the region; but no climate-related conditions be imposed on Hydro or referred to the monitoring program (p. 162);

30. the Ministry of Highways follow the procedures and practices it described at the hearings with respect to mitigating impacts of highway relocation and, in consultation with affected land owners and other government agencies, in particular, the Ministry of Agriculture and food, establish and make public a definite route for the highway as soon as possible (p. 174).

With respect to impacts on forestry, the Commission recommends that, as a condition of an Energy Project Certificate:

31. Hydro be required to pay compensation of $1 million less stumpage fees from clearing for forestry losses due to flooding (p. 180).

The Commission further recommends that:

32. the Ministry of Forests canvass the views of the Ministry of Environment and the Ministry of Lands, Parks and Housing to establish clearing standards that best serve the goals of forestry, environment and recreation (p. 179-80);

33. prior to the issuance of an Energy Project Certificate, the value of forestry losses resulting from transmission line clearing be determined on the same basis as used for reservoir losses and compensation be paid for these losses as well (p. 180);

34. forestry compensation payments be directed to a program managed by the Ministry of Forests aimed at enhancing forestry activity and potential in the region (p. 180).

With respect to general outdoor recreation the Commission recommends that as a condition of an Energy Project Certificate:

35. Hydro be required to pay $6.9 million as compensation for general outdoor recreational resource losses (p. 189).

The Commission further recommends that:

36. these funds be used to develop programs under the Ministry of Lands, Parks and Housing, in consultation with local authorities, that will enhance recreation both on the reservoir and on the remaining rivers in the region (p. 189);

37. $50,000 of these compensation funds be used by Hudon's Hope for the development of Alwin Holland Park and $20,000 be used by the River Rats Club for development of wilderness campsites (p. 189);

38. $833,000 of the compensation funds be directed to wildlife programs in the region developed and administered by the Fish and Wildlife Branch of the Ministry of Environment in recognition of non-consumptive wildlife losses (p.190);

39. except as otherwise recommended above, the Ministry of Lands, Parks and Housing or appropriately designated public bodies be responsible for all new recreational facilities including those on the reservoir, and that Hydro be given public credit for its financial contributions (p. 189).

With respect to wildlife and recreational hunting losses, the Commission recommends that as conditions of an Energy Project Certificate:

40. Hydro undertake a number of mitigation measures related to transmission line development and construction as outlined on pages 197 of this report (p. 197);

41. Hydro pay $2.8 million as compensation for recreational hunting resource losses (p. 198).

The Commission further recommends that:

42. these funds be directed to wildlife enhancement programs in the region to be developed by the Ministry of Environment in consultation with local groups (p. 198).

With respect to impacts on fisheries and recreational fishing, the Commission recommends that, as conditions of an Energy Project Certificate:

43. Hydro conduct a detailed angling and creel survey, gather information on sport fish movement in the Peace River and tributaries to assist in determining the impacts of flooding, and conduct a study to ascertain the most effective manner in which shoreline enhancement programs and tributary might be developed for the reservoir (p. 203-4);

44. Hydro undertake a number of mitigation measures as specified on page 207 of this report to minimize impacts during construction and transmission line development (p. 204).

The Commission further recommends that:

45. when Hydro's studies are completed the level of compensation be determined using evaluation parameters established in this report, and appropriate compensation programs be determined as part of the monitoring program (p. 207);

46. The appropriate government agency undertake studies to determine the productivity of existing man-made reservoirs in order to provide more information on the biological impact of the conversion of rivers to reservoirs (p. 205).

With respect to impacts on water quality and downstream users, the Commission recommends that as a condition of the Energy Project Certificate:

47. Hydro be required to institute a program in consultation with Westcoast, in order to identify and measure impacts (p. 210).

With respect to impacts on heritage resources, the Commission recommends that as a condition of the Energy Project Certificate:

48. Hydro match funds raised by the Heritage Conservation Branch up to a limit of $500,000 for the extra capital cost for an accelerated excavation program (p. 214).

3.2 Regional Economic and Social Impacts

With respect to regional economic impacts, the Commission recommends that:

49. Hydro and the Ministry of Labour consult with the appropriate trade unions to facilitate increased local membership at least during the construction period of the project (p. 225);

50. the need for a training program be determined immediately before an Energy Project Certificate is issued based on economic conditions prevailing at that time (p. 225);

51. the timing of the project not be governed by prevailing regional economic conditions even though they are important in determining the extent of social benefits (p. 226).

With respect to infrastructure and financial impacts on local municipalities and the regional districts, the Commission recommends that:

52. the matter of impacts and mitigation and compensation for the City of Fort St. John be referred to the monitoring program; the existing negotiated agreement between Hydro and the City should not be made a condition of the Energy Project Certificate (p. 230);

53. Hydro not be required to pay for increased costs claimed by the Village of Taylor regarding its recently completed water intake (p. 232);

54. Hydro monitor the bedrock banks and overburden banks as part of its slope stability monitoring program, and design and construct a berm to protect Hudson's Hope's residents (p. 233-4);

55. Hydro provide financial compensation to the Corporation of Hudson's Hope for an amount equal to the estimated decline in property tax revenue attributable to lost land plus the replacement or repair cost of municipal works, land and facilities that will be lost or damaged, determined by negotiation between Hydro and the Corporation of Hudson's Hope or referred to the monitoring program if a resolution or agreement cannot be reached (p. 234);

56. any net revenue shortfalls of the regional district be dealt with by the monitoring program (p. 235).

With respect to the social service impacts, the Commission recommends that:

57. assessment of the magnitude and incremental cost of health, hospital and other social service impacts resulting from the project be referred to the monitoring program (p. 237).

With respect to social and economic impacts on native communities, the Commission recommends that:

58. impacts on native hunting, trapping and fishing and social impacts be dealt with by the monitoring program (p. 242);

59. compensation for recreational hunting losses be made in kind through wildlife habitat enhancement programs (p. 245);

60. Indian communities be responsible for reporting impacts to the monitoring program and suggesting remedial measures (p. 246);

61. Hydro be required to provide funds for those remedial measures that have been approved by the monitoring authority and that neither Hydro nor the Ministries be required to make any direct payment to the native people (p. 245);

62. the evidence submitted by the Treaty 8 Tribal Association be reviewed by the appropriate federal and provincial ministries to consider the question of cumulative impacts of development on the northeast native economy (p. 243).

3.3 Monitoring Program

With respect to a monitoring program, the Commission recommends that as a condition of an Energy Project Certificate:

63. Hydro fund and be subject to a monitoring program which should be established by the government to deal with unresolved or unanticipated impacts and to verify compliance with all conditions specified in the Energy Project Certificate (p. 250).

In terms of the structure and operation of the program the Commission recommends that:

64. the monitoring program terminate upon completion of construction (p. 253);

65. the responsibilities of the monitoring program be carried out by a monitoring commissioner appointed by Cabinet pursuant to Section 25.1 of the Utilities Commission Act (p. 255);

66. the monitoring commissioner, aided by a small staff, draw as far as possible on the resources of existing ministries or agencies and that each provincial ministry and local government agency designate a person to work with the monitoring commissioner in this regard (p. 256);

67. the monitoring commissioner have the authority to order Hydro to take such measures as deemed appropriate by him and to the appropriate Ministries necessary action on their part (p. 256);

68. the monitoring commissioner's decisions be subject to review; for this reason the monitoring commissioner should be a temporary or permanent member of the B.C. Utilities Commission (p. 257);

69. Hydro be required to provide base funding for the monitoring commissioner's salary and office staff in an amount determined by the B.C. Utilities Commission; additional funding should be reviewed by the B.C. Utilities Commission based on the recommendations of the monitoring commissioner (p. 257);

70. Cabinet direct the permanent Utilities Commission to review any decision of the monitoring commissioner at Hydro's request (p. 258);

71. costs incurred by complainants in bringing a matter to the attention of the monitoring commissioner be borne by the complainants themselves unless otherwise directed by the monitoring commissioner (p. 258).

4.0 OTHER APPROVALS AND OTHER MATTERS

4.1 Other Approvals

With respect to other approvals, the Commission recommends that:

72. the Comptroller of Water Rights issue a Water License incorporating terms addressed in Chapter XI and XIX of this report and outlined in Appendix 9 (p. 290-3);

73. Cabinet direct the Minister of Environment and managers under the Water Management Act to issue such permits as Hydro will require for the construction of Site C provided Hydro demonstrates it will employ techniques most likely to minimize pollution (p. 294);

74. Cabinet of its own motion exclude affected land from the Agricultural Land Reserve if and when it issues an Energy Project Certificate (p. 295).

4.2 Other Matters

The Commission recommends that:

75. forecasts made by Hydro and MEMPR employ a common data base and definitions of sectors and years (pg. 299);

76. government re-evaluate electricity export policy (p. 300);

77. government clarify industrial development policy (p. 301);

78. Hydro reinstitute its passive land acquisition policy until an Energy Project Certificate is issued (p. 302);

79. Hydro offer to include buy-back provisions in all private property acquisitions for the project (p. 303);

80. any inquiry into future northern river development should examine the cumulative impacts of the entire development of each basin and not just the first step of the development (p.306).

PART TWO INTRODUCTION

CHAPTER III - BACKGROUND

1.0 THE UTILITIES COMMISSION ACT

On September 11, 1980, with the proclamation of the Utilities Commission Act S.B.C. 1980, Chapter 60, the British Columbia government established a new process for the review and approval of major energy projects in the province. The Act requires that proponents of all regulated projects obtain from the Minister of Energy, Mines and Petroleum Resources an Energy Project Certificate before starting construction. Regulated projects include high voltage transmission lines 500 kilovolts or greater, power generation plants over 20 megawatts, facilities that can ship, store or use more than 3 petajoules of energy, pipelines capable of carrying more than 16 petajoules per year and other facilities as specified in Section 16 of the Act.

To obtain an Energy Project Certificate, proponents must submit an application to the Minister of Energy, Mines and Petroleum Resources, providing the information that is prescribed in the Regulations under the Act (B.C. Reg. 388/80). On receiving an application the Minister has three options: (i) he can refer it to the B.C. Utilities Commission for review under Part 2 of the Act; (ii) in the case of provincially regulated utilities, he can order that the application be heard by the Utilities Commission as an application for a Certificate of Public Convenience and Necessity under Part 3 of the Act; or (iii) he can order that the project be exempt from all or any provisions in the Act. The first and third options require the agreement of the Minister of Environment.

When an application is referred to the Commission for review under Part 2 of the Act, the Commission is required to hold public hearings in accordance with terms of reference specified by the two Ministers. Recommendations on whether or not an Energy Project Certificate should be issued and if so, what conditions should apply, are then made by the Commission to the Lieutenant Governor-in-Council. At that point, Cabinet can approve or deny the application and attach any conditions it deems advisable. Once an Energy Project Certificate has been issued, an Energy Operating Certificate will be issued if, during construction, the conditions of the Energy Project Certificate have been met.

2.0 SITE C APPLICATION

Prior to September 11, 1980, hydro-electric development in the province was regulated by the Water Act, R.S.B.C. 1979, Chapter 429. That Act empowered the Comptroller of Water Rights to hold a public hearing to hear the submissions of those who had registered objections to an application for a Water Licence. Hydro applied for a Water Licence for its proposed Peace River Site C hydro-electric project, and a number of objections were filed with the Comptroller. However, the provisions of the Water Act and the processes under it were superseded by the proclamation of the Utilities Commission Act. On September 29, 1980, the British Columbia Hydro and Power Authority applied for an Energy Project Certificate under that Act for the proposed Site C Project.[1]

The project requires the construction of an earthfill dam across the main channel of the Peace River, about 1 kilometre downstream of the mouth of the Moberly River, and some 7 kilometres southeast of the City of Fort St. John. The dam would raise the water level about fifty metres, and it would create a reservoir with a surface area of some 9440 hectares, about 4600 hectares of which would be newly flooded land. Facilities include six power intakes, penstocks and generating units. The project also requires a spillway, temporary and permanent access roads, and a diversion tunnel during construction.

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[1] B.C. Hydro and Power Authority, Peace Site C Project Application for an Energy Project Certificate with Supplemental Material, Ex 15.

In addition to the dam, powerhouse and related facilities, two 500 kilovolt (kV) transmission lines between Site C and the existing Peace Canyon hydro plant, and one additional 500 kV circuit between the Williston Substation at Prince George and Kelly Lake, are proposed.

The six-unit Site C hydro-electric plant would provide approximately 940 megawatts (MW) of nameplate capacity and, as estimated in the Application (Ex 15:B-9), 4455 gigawatt hours (GWh) of firm annual hydro-electric energy and 4530 GWh of energy per year under average water conditions. The transmission facilities would permit the delivery of that energy to the grid at Kelly Lake.

3.0 B.C. ORDER-IN-COUNCIL, APRIL 23, 1981[1]

In response to Hydro's application, the government, under Section 19(1a), Part 2 of the Act, referred the matter to the Utilities Commission for review. By Order-in-Council dated April 23, 1981, a special division of the Commission consisting of a Chairman and three other temporary Commissioners and one permanent Commissioner was appointed to hear the application. A brief biographic note on each of the Commissioners is found in Appendix 3.

4.0 TERMS OF REFERENCE[2]

Terms of reference for the review were determined jointly by the Minister of Energy, Mines and Petroleum Resources and the Minister of Environment and were transmitted to the B.C. Utilities Commission on April 23, 1981.

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[1] Reprinted in Appendix 2.

[2] Reprinted in Appendix 4.

These terms of reference require consideration of the following :

(a) Project Justification

Including consideration of electricity demand relative to supply in a total energy context and relative to industrial development opportunities to be made available in the province; financial impacts; and social benefit-cost, taking into account environmental, land use, social and economic effects.

(b) Project Design and Costs

Including consideration of the adequacy and safety of all works and undertakings.

(c) Land Use, Environmental, Social and Economic Impacts

With specific regard to land use and regional settlement, agriculture, forestry, outdoor recreation, terrain resources, wildlife, hydrology, local climate, infrastructure, social services, social structure and local economies.

(d) Other Matters

Including whether approvals should be provided under specified sections of the Pollution Control Act and the Water Act, all matters regarding the Applicant's Water License Application, and any other issues deemed to be relevant by the Commission including those related to the issuance of a Certificate of Public Convenience and Necessity.

The terms of reference further direct that the Commission submit a report and recommendations to the Lieutenant Governor-in-Council on :

(a) whether or not an Energy Project Certificate should be issued;

(b) the conditions that should be attached if Energy Project and Energy Operating Certificates are recommended; and

(c) the granting of approvals, permits or licences and terms and conditions under the Pollution Control Act and the Water Act.

CHAPTER IV - INTERPRETATION OF TERMS OF REFERENCE

1.0 DOCUMENTS TO BE REVIEWED

The terms of reference for the review of Hydro's proposed Site C project are broad, calling for an examination and assessment of virtually all aspects and potential impacts of the proposed project.

In addition to specifying the wide range of questions and issues that the government wants the Commission to address, the terms of reference also refer to a number of documents the Commission is to take into consideration in its review. These include the Government of British Columbia's Energy Policy Statement of February 1980 (An Energy Secure British Columbia: The Challenge and the Opportunity) (Ex 46), and, as appropriate, the province's Environmental and Social Impact Compensation/Mitigation Guidelines (Ex 229), and Guidelines for Benefit-Cost Analysis (Ex 122) for the project justification component of the review. They also refer to the Utilities Commission Act itself.

The Commission has attempted to ensure that, insofar as possible, its report and recommendations are consistent with the documents to which it was referred. The Commission's understanding of these documents and their significance for the Site C review are outlined below.

2.0 GOVERNMENT OF BRITISH COLUMBIA'S ENERGY POLICY STATEMENT OF FEBRUARY 1980

The introduction to the Energy Policy Statement (Ex 46) describes the overall approach of the provincial government to energy projects.

> "... the key word is stewardship. We - the Government on behalf of the people of B.C. - are entrusted with the management of our energy resources. Just having resources is not enough. They require careful and responsible government."

The Policy Statement goes on to describe the role of the hearing process in facilitating stewardship :

> "Major energy projects have significant social, environmental and economic implications. Recognizing the need for comprehensive, advance evaluation of these energy developments, the Government will set up a new, integrated review process.
>
> This process will streamline, not shortcut, the review process now in place. This streamlining will ensure that socially and economically desirable projects will be evaluated with a minimum delay, while also ensuring that all appropriate safeguards will be taken.
>
> Major developments will be permitted only after full consideration of the impact on our economy and environment."

The Policy Statement also comments on the role of hydro-electric projects in the development of the province's energy resources. It draws attention to some of the most significant factors in assessing these projects.

> "We still have considerable untapped hydro-electric potential, and British Columbia Hydro is currently investigating remote sites which could be used to meet the continuing growth in demand for electricity. But because of their remoteness from major load centres, development and transmission costs will be higher than in the past. In assessing future hydro-electric developments, it is important to stress that alternative sources of energy - as well as social, economic and environmental factors - will all be carefully weighed and that the balancing of these factors will determine whether a project will proceed."

The Policy Statement also discusses the appropriate role of Hydro in undertaking hydro-electric projects. It says the importance of these projects to the Province requires that only Hydro, the province's public utility, undertake them.

> "The province's hydro-electric potential is perhaps the strongest attraction for firms considering where to locate and expand. As well as economic benefits, hydro-electric projects also have significant social and environmental consequences. Therefore, the Government must take the leading role in guiding future hydro-electric development to ensure that these projects are in the best overall interests of the Province; that a secure and reliable source of electricity is available to meet the Province's normal growth; and that electrical energy is available to all industries on a fair and equitable basis."

TO ACCOMPLISH THESE AIMS, THE GOVERNMENT WILL REQUIRE THAT ALL FUTURE HYDRO-ELECTRIC DEVELOPMENT BE CARRIED OUT BY THE PROVINCE'S PUBLIC UTILITY - THE BRITISH COLUMBIA HYDRO AND POWER AUTHORITY - AND THAT THESE DEVELOPMENTS BE IN ACCORDANCE WITH POLICY DIRECTIONS SET BY THE GOVERNMENT (Ex 46:10, emphasis in original).

These statements, together with the terms of reference for these hearings, indicate to the Commission that the government wishes to have proposed energy projects assessed in the context of the province as a whole and in the context of the province's total energy policy.

3.0 UTILITIES COMMISSION ACT AND B.C. HYDRO AND POWER AUTHORITY ACT

The Utilities Commission Act became law in September 1980 and put into effect many of the policies expressed in the Policy Statement. Part 2 of the Act empowers the Minister to assess major energy projects and enables him to obtain advice from the Commission when he considers such advice necessary. Part 3 of the Act subjects Hydro to regulation as a public utility for the first time.

The British Columbia Hydro and Power Authority, or Hydro, was created in 1962 by the Hydro and Power Authority Act, subsequently amended and currently R.S.B.C. 1979, c. 188. It gives Hydro broad powers regarding the generation and supply of power in the province and the additional necessary authority to carry out its work. It does not impose any obligation on Hydro to pursue any particular policy goal. Hydro's only obligations are those generally imposed on public utilities by the common law.

The two Acts together invest Hydro with broad powers to produce and supply energy subject to regulation by the Utilities Commission, to ensure that its actions are consistent with the interests of the province as a whole. In the case of Site C, the Commission is the vehicle chosen by government to provide indirect policy guidance to Hydro through Cabinet under Part 2 of the Act to ensure that development of Site C, if it were approved, is undertaken in a manner consistent with the best interests of the people of B.C.

4.0 THE PROVINCE'S GUIDELINES FOR BENEFIT-COST ANALYSIS AND ENVIRONMENTAL AND SOCIAL IMPACT COMPENSATION/MITIGATION GUIDELINES

The Guidelines for Benefit-Cost Analysis (Ex 122) were developed so that projects could be assessed on a consistent basis. They are designed to ensure that public financial resources are allocated to those projects that are most beneficial to the people of the province. The Environmental and Social Impact Compensation/Mitigation Guidelines (Ex 229) were developed to establish a consistent, fair approach to determining the compensation and mitigation measures to be taken with respect to projects affecting public resources and communities.

5.0 COMMISSION'S INTERPRETATION OF TERMS OF REFERENCE

The Commission interprets its terms of reference to direct it to assess the Site C project, not from the viewpoint of any particular entity, person or group of persons but from the viewpoint of the province as a whole. This is the position the Commission has taken in weighing and assessing the evidence and in reaching its conclusions and recommendations.

CHAPTER V -REVIEW PROCEDURES

1.0 PREHEARING PROCEDURES

Upon receiving its terms of reference, the Site C Division of the British Columbia Utilities Commission began to review Hydro's application and to consider appropriate procedures. Commission staff and consultants advised the Panel on the application's technical aspects, and legal counsel was retained to advise on procedural matters and to serve as Commission Counsel throughout the review.

The Commission ordered Hydro to publish a Notice of hearing by June 30, 1981 asking all interested parties who wished to intervene in the hearings to identify themselves to the Commission in writing. Such identification was all that was required in order for individuals or organizations to participate. The Notice of Hearing was published in newspapers throughout B.C. and in some nearby Alberta communities. In addition, the Commission wrote to all registered objectors to the application under the Water Act informing them that their objections would be considered by the Commission, and asking them to indicate their intention to participate in the hearing if they so wished. A total of 115 interventions were ultimately received in response to these notices.

As part of its prehearing activities, on June 18, 1981, the Commission visited the site to familiarize itself with the proposed project area. An informal meeting was held in Fort St. John on July 30, 1981 at which the public was invited to offer comments and suggestions on how the review should be carried out. A formal prehearing conference was held on October 7, 1981 to hear submissions on, and to establish procedures for, the hearing. During this period, interested parties registered with the Commission as intervenors and both the Commission and the intervenors reviewed the application in detail.

Requests for additional information were made by the intervenors and forwarded to Hydro through the Commission for response. The Commission itself had specific questions concerning the application and presented Hydro with a detailed request for supplemental information, to which Hydro responded in a two-volume report (Ex 20 and Ex 21).

The Commission considered that to make the review comprehensive it would be important to have the input from a number of government ministries concerned with various aspects of the Site C project and its impacts. In response to a request from the Commission the ministries submitted "Blue Papers" containing their views on what needed to be done and also provided witnesses to answer questions about those papers.

In a series of Orders issued between June 19, 1981 and October 27, 1981 (Ex 3 to 10), the Commission established procedures and proposed a date for the hearings to begin. The Commission planned both formal hearings and less formal community hearings. The formal hearings involved presentation and cross-examination of evidence relating to the application. The community hearings gave individuals interested in the project an opportunity to express their views in a less structured setting. Cross-examination by and of Hydro was not permitted at these community hearings.

At both the July 30, 1981 meeting and the prehearing conference on October 7, 1981, several intervenors asked that the Commission consider awarding of costs. The Commission indicated it would accept applications for costs at the end of each phase, and that awards would be based on specific criteria and guidelines. The initial Order on this matter, indicated that "a significant criterion that will be used in the determination of cost awards, aside from need, will be the degree to which the intervention contributes to the understanding of the issues raised by the application" (Ex 6: Appendix A). This test was applied throughout the review.

At the prehearing conference and in subsequent Orders, the Commission emphasized the importance of minimizing duplication of information and effort. To this end, the Commission had its own consultants produce reports on each major phase of the hearing for distribution to all parties. In addition, the Commission encouraged intervenors to coordinate their activities whenever possible so that information would be presented as concisely and effectively as possible.

To facilitate the orderly presentation of evidence and to assist intervenors in identifying what aspects of the application would be considered at particular stages in the proceedings, the Commission divided the formal hearings into six phases:

I - Demand

II - Supply

III - Project Cost and Adequacy of Design

IV - Environmental, Land Use, Social and Economic Impacts, and Economic Cost-Benefit Evaluation

V - Financial Impacts on Hydro and on Electricity Users

VI - Final Argument.

The formal hearings were initially scheduled to be held entirely in Fort St. John, with the exception of special Vancouver sessions for January 1982 where submissions were permitted on any aspect of the application. It was subsequently decided to hold regular formal sessions in Vancouver for the later phases of the hearings.

2.0 HEARING PROCEDURES

The formal hearings began in Fort St. John on November 24, 1981, with Hydro presenting its evidence on electrical energy demand, and were completed in Vancouver on November 2, 1982, the last day of Final Argument. In total, 80 individual witnesses or panels of witnesses were heard during the 116 days of formal hearings. Over 70% of the hearing time was spent in cross-examination, testing the evidence given by Hydro and intervenors on the Site C application. This process proved essential in clearly identifiying the issues and in clarifying the evidence on which the Commission could base its report.

Six less formal community hearings were held in towns located near the proposed project. Two were held in Fort St. John and the others at Taylor, Hudson's Hope, Chetwynd and Dawson Creek. Sixty-three individuals expressed their views on the application during these less formal community hearings. At the request of the Treaty 8 Tribal Association, special hearings were also held with the Saulteau, West Moberly, Blueberry, Doig and Halfway River Indian bands on or near their reserves. Forty-six native people expressed their views at these meetings.

3.0 REPORT AND RECOMMENDATIONS

The following report constitutes the response of the Site C Division of the British Columbia Utilities Commission to the Government of British Columbia on all matters raised in the terms of reference. The conclusions and recommendations are based on the evidence presented and examined during the hearings.

The Site C Division of the B.C. Utilities Commission is satisfied that the conclusions and recommendations contained in this report are well founded and provide a solid basis for government decisions.

PART THREE PROJECT JUSTIFICATION

CHAPTER VI INTRODUCTION TO PROJECT JUSTIFICATION

1.0 TERMS OF REFERENCE

With respect to project justification, the Minister of Energy, Mines and Petroleum Resources and the Minister of Environment directed the Commission -

> to review the requirement for the project, including consideration of electricity demand forecasts relative to supply in a total energy context, and industrial opportunities made available in the Province; the project's financial impacts on the Applicant and on electricity users; and the project's overall impact on the Province, specifically its social benefit-cost, including environmental, land use, social and economic impact.

The Ministers further directed that -

> The Province of British Columbia's Environmental and Social Impact Compensation/Mitigation Guidelines and Guidelines for Benefit-Cost Analyses are to be used as a reference to the above review, as appropriate.

These broad terms of reference call for the Commission to consider the need for the project in terms of future electricity demand and supply in the province, and the total financial, economic, social, and environmental impacts of the project on the province as a whole.

The purpose of Part Three of the report is to present the evidence and draw conclusions on project justification from this broad perspective.

2.0 ORGANIZATION OF PROJECT JUSTIFICATION REVIEW

The following basic issues are addressed in the project justification review:

i) Does society in British Columbia value the benefits of further hydroelectric or other electrical energy by an amount at least as great as its total social cost?

ii) When will new electricity supply be required or be of benefit to the Province, in light of future demand relative to supply?

iii) Is Site C the appropriate source of supply to meet new power requirements from a broad provincial perspective?

Chapters VII and VIII contain the findings on electricity demand and supply. This material relates directly to the question of need. Chapter IX contains the findings on the financial impacts. Chapter X contains the Commission's conclusions on the justification of the project and its related recommendations regarding the issuance of an Energy Project Certificate.

CHAPTER VII - ELECTRICAL ENERGY DEMAND

1.0 FORECAST RESULTS

Only two panels presented specific forecasts of future electricity requirements in the province — Hydro and the Ministry of Energy, Mines and Petroleum Resources (MEMPR). Other demand projections were made but they really constituted evaluations of the effects on demand of specific variables like price, rather than independent forecasts of future requirements.

1.1 B.C. Hydro

Over the course of the hearings, Hydro submitted three forecasts of electricity requirements for its service area: the September 1981 forecast (Ex 27); the May 14, 1982 Interim Forecast (Ex 265A); and the September 1982 forecast (Ex 429). In addition, Hydro filed a 1982 econometric forecast of energy requirements in the province which was prepared for them by Datametrics Ltd. (Ex 432).

Hydro based its original and final submission on the need for Site C on September 1981 and September 1982 forecasts. (These two forecasts were examined in detail during the hearings.) The "low", "probable" and "high" ranges are shown in Table I and depicted graphically along with the Ministry's 1981 forecast in Figure 3.

TABLE I
B.C. Hydro's September 1981 and September 1982 Electricity Load Forecasts
(GWh)

		Sept. 81			Sept. 82	
	Low	Prob.	High	Low	Prob.	High
1980/81[a]	31,114	31,114	31,114	31,158	31,158	31,158
1981/82[b]	32,040	32,040	32,930	32,359	32,359	32,359
1982/83	35,110	36,160	37,140	31,800	32,570	33,100
1983/84	36,920	38,690	40,330	33,600	34,320	35,400
1984/85	38,420	41,540	44,120	35,300	36,310	38,000
1985/86	39,580	43,690	47,450	36,600	38,060	40,100
1986/87	40,590	46,160	51,470	38,300	40,290	42,700
1987/88	41,680	48,410	55,410	39,500	42,120	45,000
1988/89	42,320	50,390	59,190	40,700	43,650	47,200
1989/90	43,150	51,670	63,840	41,500	45,340	49,300
1990/91	43,990	54,770	67,820	42,900	47,290	51,900
1991/92	44,910	57,090	72,500	44,000	49,570	55,000
1992/93	46,100	59,700	77,300	44,700	51,150	57,000
AAGR[c] 1980/81-1991/92	3.4	5.7	8.0	3.2	4.3	5.3
1981/82-1992/93	3.4	5.8	8.1	3.0	4.3	5.3

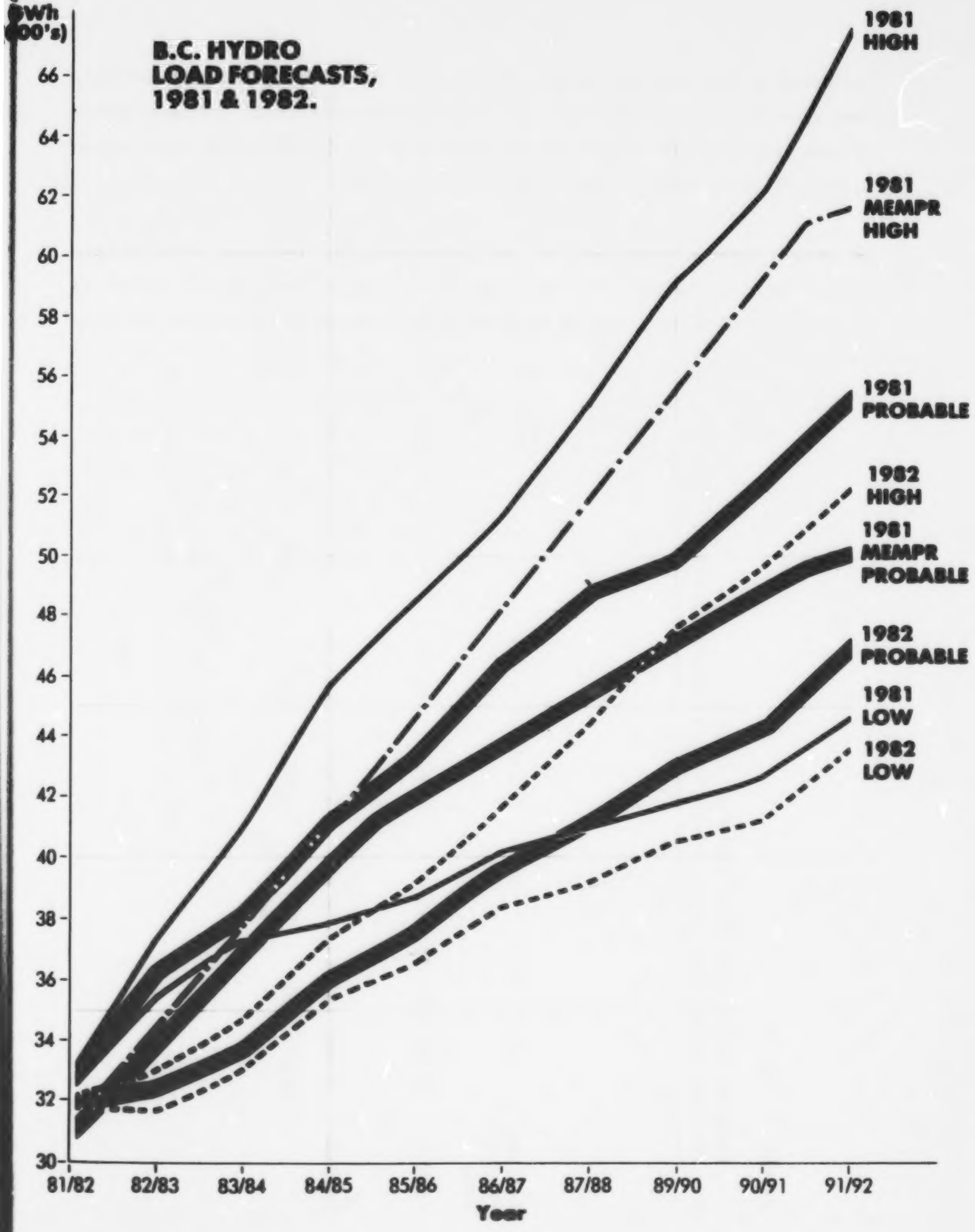
a Actual or estimated actual.

b Actual in case of September 1982 forecast only.

c Average Annual Growth Rate.

Sources: Ex 27 and Ex 429

FIGURE 3


B.C. HYDRO
LOAD FORECASTS,
1981 & 1982.
Wh
00's)
66
64
62
60
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56
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52
50
48
46
44
42
40
38
36
34
32
30
81/82
82/83
83/84
84/85
85/86
86/87
87/88
89/90
90/91
91/92
Year
1981 HIGH
1981 MEMPR HIGH
1981 PROBABLE
1982 HIGH
1981 MEMPR PROBABLE
1982 PROBABLE
1981 LOW
1982 LOW

As shown in the table and graph, Hydro's 1982 forecast indicates considerably less growth than its 1981 forecast. The forecast "probable" average annual growth rate fell from 5.7% (1980/81-1990/91 in the September 81 forecast) to 4.3% (1981/82-1992/93 in the September 82 forecast).

In Table 2 Hydro's September 1981 and September 1982 "probable" forecasts are broken down by sector. The table shows that a reduced rate of growth is expected in all sectors, though particularly pronounced in the general and bulk categories.

TABLE 2

B.C. Hydro's September 1981 and September 1982 Probable Forecast by Sector

(GWh)

	Sept. 81					Sept. 82				
	Res.	Gen.	Bulk	Losses	Tot.[a]	Res.	Gen.	Bulk	Losses	Tot.[a]
1980/81	8,042	9,344	9,597	3,594	31,158	8,042	9,344	9,597	3,594	31,158
1992/93	12,660	16,148	21,345	6,608	59,700	11,735	13,540	17,295	5,823	51,150
AAGR 1980/81-1992/93	3.9	4.7	6.9	5.2	5.6	3.2	3.1	5.0	4.1	4.2

[a] Includes other load requirements not elsewhere specified, such as Cominco and West Kootenay Power and Light Company, Limited.

Source : Ex 429

1.2 Ministry of Energy, Mines and Petroleum Resources

The forecast of electricity requirements submitted by the Ministry was taken from its 1981 provincial total energy forecast for the period 1980-1995. The base and high ranges of electricity requirements in the Ministry's forecast are shown in Table 3 below.

TABLE 3

Ministry of Energy, Mines and Petroleum Resources
1981 Electricity Requirements Forecast
(GWh)[a]

	Base	High
1980[b]	41,670	41,948
1985	51,671	53,338
1990	58,894	67,228
1995	62,227	77,228
AAGR 1980-1990	3.5	4.8
AAGR 1980-1995	2.7	4.2

[a] MEMPR forecast in petajoules converted to GWh @ 1 PJ = 277.8 GWh.

[b] Preliminary

Source: Ex 55:9-2.

The Ministry's forecasts are not directly comparable to Hydro's for several reasons. First, the commercial and industrial sectors are not the same as Hydro's general and bulk categories. Second, the Ministry's forecasts are for all requirements in the province as a whole, whereas Hydro's are for purchased requirements in its own service area. Finally, the Ministry's forecasts are for calendar years, whereas Hydro's are for its (April 1 to March 31) fiscal years.[1]

Table 4 and Figure 3 show the Ministry's adjusted forecasts of total purchased electricity requirements for Hydro's service area. The 10-year 1980-1990 growth rate of electricity requirements in the adjusted forecast is 4.7% per year. This is higher than the growth rate for the province as a whole (forecast at 3.65% per year) because of the Ministry's assumption that Hydro will have to meet all major incremental requirements in the province, including those not in its current service area (Ex 55:9-3).

TABLE 4

Adjusted 1981 Ministry of Energy, Mines and Petroleum Resources Forecast
(GWh)

	Ministry Base Case for Province	Adjusted Ministry Base Case for B.C. Hydro Service Area
1980	41,670	30,558
1985	51,671	41,114
1990	58,894	48,337
1995	62,227	51,671
AAGR 1980-1990	3.5	4.7
AAGR 1980-1995	2.7	3.6

Source: Ex 55:9-2; 9-4.

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[1] See Chapter XX regarding conclusions and recommendation for rationalizing the two forecasting procedures.

The Ministry's forecast for the Hydro service area is only slightly lower than Hydro's "probable" September 1981 forecast over the 1980 to 1990 period. The difference in the forecasts is more marked after 1990. The Ministry did not submit a 1982 forecast of electrical energy requirements to the Commission.

2.0 THE ISSUES

A number of major issues were identified in the submissions on demand. The principal issues relate to -

- forecast methodology and reliability
- the role and forecast of key underlying variables
- specific factors such as industrial sector growth, technological change, interfuel substitution, conservation and self-generation
- prospects and potential in the export market.

These issues are discussed below.

2.1 Forecast Methodology and Reliability

For its September 1981 forecasts, Hydro used a variety of methodologies to develop its 10-year projections of total electricity requirements. Residential sector sales were forecast by estimating the number of heating and nonheating accounts and then multiplying by the estimated average use of each type of account. The number of accounts was forecast on the basis of future population growth; use per account was forecast on the basis of past trends, but with the estimated effects of conservation taken into account.

General sector sales were forecast by using an historical exponential relationship between sales and gross provincial domestic product (GPDP), adjusted to take into account the estimated effect of conservation. Bulk sector sales were forecast using a subjective approach based on customer requests for power. Forecast purchases by West Kootenay Power and Light and Cominco were based on forecasts provided by those companies.

The forecasting process used by Hydro draws on the resources of numerous departments. For projecting over the short term (i.e., two years), primary emphasis is placed on the input of the power district managers,[1] who provide a two-year projection of customers, average annual energy use and sales by customer, as well as a five-year projection of customers by class. Longer-term projections (the remainder of the 10-year period) are made at Head Office by the Load Forecast Department, which draws on the Energy Conservation Division for estimates of conservation by end-use in the residential and general sectors; on the Corporate Economist Department for the long-term economic outlook, including projections of population, GPDP, energy prices and industry outlooks; and on the Special Power Contracts Department for Bulk Sector sales information.

The Commission heard considerable evidence regarding Hydro's forecasting record. In presenting the September 1981 forecast, Hydro acknowledged that:

> Quite frankly, our forecasting record, like that of other energy forecasts, has deterioriated during the energy troubled seventies. (1:46)

A review of its past forecasts indicated that during the 1970's Hydro overestimated demand by an average of 11% in the fourth year and by 37% in the eighth year following the year of the forecast. Hydro's estimates for the largest component of demand, the bulk sector, have been the poorest (Ex 12: C-14).

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[1] There are currently 58 power district managers in the Hydro system (Ex 429: 7-1). There were 57 at the time of the 1981 forecast (Ex 27: 13).

In light of this record, and based on an internal review of its forecasting procedures, Hydro indicated, when it presented its September 1981 forecast to the Commission, that it intended to develop new techniques to supplement the old. Specifically, Hydro concluded that -

1. It should establish more explicit links between forecasts and the Long-Term Economic Outlook prepared by the corporate economist.

2. It should prepare a total energy forecast for 1982 given the increasing volatility of prices and the availability of alternative fuels.

3. As part of a total energy forecast, it should develop the ability to take explicit account of price effects -- both own-price and cross-price elasticities.[1]

4. It should include other techniques, such as econometric modelling, in its long-term forecasting. Detailed customer-level forecasting will still be necessary for much of Hydro's planning, for example short-term revenue forecasts, distribution level planning, etc.

5. It should establish a permanent load forecast committee (Ex 29 : 7-8).

The September 1982 forecast includes two of these five changes. More explicit linkages were made to the Long-Term Economic Outlook (109 : 17,819) and a permanent load forecast committee was established (109 : 17,843-5).

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[1] These terms are defined in Section 2.2.2 of this chapter, (pg. 66).

However, due to budgetary constraints the forecast was not prepared within a total energy framework (109:17,826-7). In the future, this could be done "in conjunction with or parallel to the Ministry of Energy, Mines and Petroleum Resources..." (109:17,824). Also, the 1982 forecast did not explicitly take account of energy price effects, although some improvement in methodology over its 1981 forecast was identified (109:17,829). Finally, Hydro did not integrate econometric modelling techniques into its forecasting procedure (109:17,843). But it did retain a consultant to prepare an econometric total energy forecast as a sensitivity test (Ex 432).

In effect, in preparing the September 1982 forecast Hydro developed what was called at the hearings an "end-use/engineering" approach. While -

> the techniques ... are in many ways similar to those used in 1981 and previous years, ... generally the depth and the level of detail of the analysis have been increased. The major changes in the load forecasting methods have been:
>
> - greater emphasis in estimating the likely level of future energy prices and the resulting impact of changes in electricity use;
> - development of a residential forecasting model to facilitate more in-depth analysis of this category;
> - more detailed analysis of general sales, relating the various components of this category to the growth in certain industrial activity, to growth in commercial floor space requirements and the changing electrical requirements in new buildings, and to certain segments of population; and
> - assessments of the growth and electrical requirements of the major industrial sectors based on the resource base and world market, including coal mining and petrochemicals in addition to forestry and metals mining and smelting (Ex 429:E-1).

The Ministry of Energy, Mines and Petroleum Resources also used the end-use/engineering approach in preparing its 1981 forecast. It developed its forecast on the basis of a detailed examination of total energy use patterns and fuel shares in each sector. Projections of energy use coefficients and levels of activity for each sector were multiplied to determine sectoral demand and then totalled to determine the overall forecast.

In cross-examination of Hydro and Ministry witnesses, questions were raised about the reliability of the end-use/engineering approach. These questions related largely to consistency in the use of important variables such as price and income, and the degree of judgement applied to the large industrial user requirements (10:1,617).

In comparison to the end-use/engineering approach, the Commission heard evidence on econometric modelling of energy demand. In econometric models, a set of equations incorporating variables that explain demand (for example, output, income, energy prices, prices of other factor inputs)[1] are developed; observed patterns of behaviour (historical data) are then used to estimate the parameters in these equations. To forecast energy demand, projections of the explanatory variables are applied to the estimated equations.

The reliability of energy requirement forecasts based on econometric models clearly depends on the reliability of the projections of the explanatory variables as well as the set of equations used. As in the end-use/engineering approach, the projections of explanatory variables can be quite subjective. The advantage of the econometric approach is that it reduces the degree of subjectivity by ensuring that the effect of the explanatory variables in the forecast is consistent with statistically significant past patterns of behaviour. There is, of course, some question as to whether past relationships between price and demand are good guides to what the future will hold (109:17,834).

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[1] In the model presented by Drs. Helliwell and Margolick the variables used to explain total energy demand in British Columbia were the capital stock in Canada, the relative price (index) of energy and capital in Canada, and the relative price of energy in British Columbia versus the rest of Canada. The variables used to explain each fuel's share of total energy demand were relative fuel prices and an index of gas availability. In the econometric model prepared for Hydro by Datametrics, the variables used to explain total B.C. energy demand in the commercial and industrial sectors were output, the price of energy, the price of labour, and the capital stock. Fuel shares were explained by historical consumption, relative fuel prices and, for the industrial sector, an "urbanization index". The variables explaining residential demand were real income per household, the price of electricity, degree days (a temperature index) and previous period consumption.

With regard to forecasting reliability, Dr. Singh of the Ministry of Industry and Small Business referred to studies which suggested -

> ... that the forecasting accuracy is improving over time, and recent developments of econometric models had largely to do with that improvement. That is contrary to the general perception that the models don't necessarily improve the accuracy (21:3,536).

The Ministry of Energy, Mines and Petroleum Resources, which to date has been using an end-use/engineering approach, announced that it intends to develop an econometric model for its next forecast (9:1,437).

The Commission's consultants on load forecasting recommended that the end-use and econometric approaches be integrated in order to incorporate effectively both the technological and the economic factors in the energy sector. This view was endorsed by Hydro in final argument and supported by intervenors, including SPEC, Dr. Helliwell, and the Ministry of Energy, Mines and Petroleum Resources.

Since the load forecast is critical to the question of project justification, the manner in which the forecast is made and the confidence one can place in it are of concern to the Commission.

The Commission acknowledges and approves the steps Hydro has already taken to improve its forecast methodology. The level of detail and the background considerations that went into the September 1982 forecast indicate that the methodology has been improved over that used in the September 1981 forecast. Nevertheless, the Commission concludes that further improvements should be made in the techniques used to forecast demand. Integrating econometric techniques into Hydro's forecasting procedures may help and should be pursued. While econometric techniques cannot eliminate the inherent uncertainties about future trends in the economy, the Commission concludes that they can ensure that the energy demand forecast is consistent with the economic and price forecasts that appear reasonable at the time of the forecast.

THE COMMISSION THEREFORE RECOMMENDS THAT HYDRO BE DIRECTED TO INCLUDE TECHNIQUES SUCH AS ECONOMETRIC MODELLING IN ITS LONG-TERM FORECASTING, A CONCLUSION HYDRO REACHED IN ITS OWN INTERNAL REVIEW. Econometric modelling should be integrated into the forecasting process where it is demonstrated to be useful, and should be used for more than outside sensitivity testing. THE COMMISSION ALSO RECOMMENDS THAT HYDRO BE DIRECTED TO DEVELOP ITS ELECTRICITY FORECAST IN A TOTAL ENERGY FRAMEWORK, A CONCLUSION THAT HYDRO ALSO REACHED IN ITS INTERNAL REVIEW.

Both of these measures, the Commission concludes, will serve to increase the consistency and reliability of Hydro's forecasts. At the same time, the Commission concludes that a major cause of uncertainty in predicting future demand is the inherent uncertainty about the underlying economic conditions that drive demand. This is something that no forecasting technique can overcome.

2.2 The Role and Forecast of Key Underlying Variables

Many factors or variables can influence the demand for electricity, but perhaps the two most important are the level of income or economic activity in the province (as measured, for example, by gross domestic provincial product) and the level of electricity and other energy prices. These variables received considerable attention at the hearings.

2.2.1 Gross Provincial Domestic Product

In Hydro's September 1981 forecast, gross provincial domestic product (GPDP) played a direct role in determining the general sales forecast, but its role in determining residential and bulk sales was less clear. Several intervenors expressed concern about the absence of any clear linkage between the bulk sector sales forecast and Hydro's GPDP forecast, and some suggested that the two forecasts may even be inconsistent. Several intervenors also expressed concern about the type of linkage made between the general sales forecast and GPDP (a simple exponential relationship) since, by Hydro's own admission, this relationship has not been constant in recent years (Ex 27 : 31).

In Hydro's September 1982 forecast, several changes were made regarding linkages between GPDP and demand. In the residential sector, Hydro assumed load growth to be driven by population and household formation, and then related these to GPDP. In the general sector, Hydro assumed GPDP to be an important driving variable, though not the only one as assumed in the 1981 forecast. In the bulk sector, Hydro assumed load growth to be driven by projected growth in output in the major industrial sectors, creating a linkage to GPDP. For all sectors, therefore, GPDP played an important, explicit role in Hydro's September 1982 forecast.

Recent economic events gave rise to many questions regarding the validity of GPDP projections. When Hydro testified on its September 1981 load forecast and the Ministry of Energy, Mines and Petroleum Resources on its 1981 requirements forecast, the GPDP growth rates they had both used were generally recognized as being too high, averaging 4.0% to 4.4% real over the 1981-86 period (Ex 23:44; Ex 55:1-3). Representatives from the Ministry of Industry and Small Business Development indicated that their forecast of 4 to 4.5% annual growth over the next five years should not be relied upon—the recession was more severe than they had thought it would be (21:3,569).

For its September 1982 load forecast, Hydro reduced its GPDP projections. Indeed, lower economic growth prospects were cited as a significant factor underlying the reduction in Hydro's load forecast between September 1981 and September 1982. Nevertheless, while Hydro presented a lower GPDP forecast than it had a year earlier, questions were still raised about the magnitude of economic growth Hydro continued to project.

The GPDP forecast Hydro used for its September 1982 load forecast was prepared in July 1982 and was predicated on an immediate turnaround in the U.S. economy (3rd quarter 1982), followed shortly thereafter by a turnaround in the B.C. economy (4th quarter 1982). For 1983 and 1984, real GPDP was projected to grow at 3.2% and 4.4% respectively. For the balance of the decade, uninterrupted growth between 3.5% and 4.0% per year was expected (Ex 429:1-3).

Hydro witnesses acknowledged that the immediate turnaround assumed in the 1982 GPDP forecast was no longer valid, though the degree of adjustment, Hydro suggested, would not be great:

> the corporate economist would be looking at some slippage in those [turnaround] times, but right now not more than the one or two quarters (109:17,867).

In Table 5, Hydro's (July 1982) low, central and high GPDP projections are shown. Hydro used the central projection for its September 1982 probable load forecast and stood by it as a "best-guess" case. The low and high GPDP projections were used for developing the low and high ranges in future electricity requirements.

TABLE 5

Real Growth in B.C. GPDP
Hydro July 1982 Projections

(expressed in annual % change)

	Low	Central	High
1982[a]	-3.0	-2.0	0.3
1983	2.5	3.2	5.0
1984	2.9	4.4	6.2
1985	3.1	4.0	4.8
1986	2.9	3.6	4.2
1987	2.4	3.5	4.5
1988	2.4	3.5	4.5
1989	2.4	3.5	4.5
1990	2.4	3.5	4.5
1991	2.4	3.5	4.5

Source: Ex 429

[a] It is now apparent that actual GPDP in 1982 was below the "low" forecast.

GPDP is a key determinant of energy demand, irrespective of the forecasting techniques employed. With respect to the GPDP forecasts presented at the hearings, the Commission notes that Hydro's July 1982 GPDP projections for the last quarter of 1982 have not materialized; accordingly, Hydro's projections, at least in the short term, must be seen to be too high. Unless this is offset by rapid economic growth in the mid to late 1980's, Hydro's central GPDP projection for the entire period will be too high. To achieve Hydro's projected growth in GPDP over the forecast period would require growth rates consistently in excess of 4 to 5% in real terms in the late 1980's. The Commission heard no evidence to support such a prospect and concludes that further slippage towards Hydro's low projection may occur.

2.2.2 Electricity and Other Fuel Prices

Energy prices can affect electricity demand in two ways. First, the price of electricity can affect demand by influencing the amount of electrical energy that people and industry are willing to purchase. As with virtually all goods and services, the higher the price, the lower the amount of consumption. This is called the own-price elasticity effect.

Second, the relative price of other fuels can affect demand by influencing the type of fuel or energy source used for certain applications, like space heating, where choice is possible. The higher the relative price of competing fuels, the more electricity will be used. This is called the cross-price elasticity effect.

Most witnesses who addressed the issue of demand acknowledged the existence and potential importance of these effects: in a study undertaken for Hydro, National Economic Research Associates concluded that "a potentially significant price elasticity response to increased rates will occur" (Ex 29:9); the econometric studies presented to the Commission identified significant own-price and cross-price elasticity effects (Ex 85A and Ex 432); and, one witness indicated that an OECD[1] study found that energy demand was in fact becoming increasingly responsive to price (23:3,749-50).

The main issue addressed at the hearings was not whether prices affect demand, but whether future electricity prices have been fully taken into account in the load forecasts.

For the September 1981 forecast, Hydro's load forecasters made no explicit forecast of real electricity prices, though they did assume that electricity would remain more expensive than natural gas for space heating.[2] The 1981 Ministry of Energy, Mines and Petroleum Resources' forecast also assumed that real electricity prices would generally remain constant, though some increases in the bulk sector were expected (Ex 55:1-60).

For Hydro's September 1982 forecast, much more emphasis was placed on estimating future electricity price levels. Three projections were developed, and a trend line based on them was adopted for developing the load forecast. Case 1 was based on an expansion plan satisfying a 4.8% average annual growth in demand and the financial parameters in Hydro's Corporate Plan of May 1982. Case 2 updated Case 1 by incorporating revised interest, inflation and exchange rates presented in Hydro's July 1982 Long-Term Economic Outlook 1982-2001 (Ex 23A). Case 3 employed all the assumptions of Case 2 except for the rate of load growth, which was decreased by 0.5% to a 4.3% average annual rate. The trend line was a weighted average of Cases 1 to 3. These projections are shown in Table 6.

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[1] Organization for Economic Co-operation and Development

[2] Hydro assumed that natural gas prices would not exceed a substitution "threshold" of 75-80% of the price of electricity.

TABLE 6

Hydro Real Electricity Price Projections for September 1982 Forecast
¢/kWh

	Case 1[a]	Case 2[b]	Case 3[c]	Trend
1981/82	3.08	3.08	3.08	3.08
1982/83	3.59	3.65	3.67	3.64
1983/84	3.73	3.86	3.90	3.82
1984/85	4.26	4.55	4.61	4.44
1985/86	4.20	4.50	4.60	4.40
1986/87	3.97	4.26	4.38	4.18
1987/88	3.83	4.04	4.18	3.98
1988/89	3.66	3.86	3.95	3.80
1989/90	3.64	3.83	3.44	3.80
1990/91	4.08	3.91	3.51	3.80
1991/92	4.35	3.89	3.72	3.80
Average Annual Growth Rate 1981/82 - 1991/92	3.5%	2.4%	1.9%	2.1%

a Based on expansion plan (4.8% average annual load growth rate) and financial parameters in Hydro's Corporate Plan of May 1982.

b Based on revised interest, inflation and exchange rates presented in Hydro's 1982 Economic Outlook.

c Same as Case 2 but with 0.5% lower load growth (i.e. 4.3% average annual growth rate).

Source: Ex 429

The trend line price projection exhibits a sharp increase in the early to mid 1980's, moderating towards the end of the decade. Over the 10-year period, the average real increase is expected to be about 2.1% per year.

In the financial phase, and to some extent, in the demand phase of the hearing, many questions were raised about the factors underlying the price projections. The forecast of electricity sales itself plays a key role. In the short term, and particularly with Revelstoke coming on-stream, reduced sales have a marked upward influence on price. With costs for the most part fixed in the short term, lower sales means that a greater amount of costs must be recovered from each kWh that is sold. Over the long term, however, as the reduced sales outlook causes a deferment of new expensive capacity, prices tend to fall or moderate relative to what they might otherwise be. In a hydroelectric system like Hydro's, long term price increases are due almost entirely to the rolling-in of new high-cost sources of supply. As the new sources are deferred, so are the accompanying price increases.

These factors, as well as current financial conditions, explain the new pattern of electricity prices anticipated by Hydro. They also suggest that if sales fall even further than Hydro is currently forecasting, sharper price increases can be expected in the near term, and greater, or perhaps longer, moderation of prices can be expected in the more distant future.

The Commission concludes that real electricity prices can be expected to increase over the next decade, with particularly pronounced increases over the next five years. To the extent that these increases, or indeed any other factors, cause electricity demand to fall further than Hydro is currently expecting, an even greater upward pressure on price could occur in the short term. The Commission agrees with Hydro that the impact of lower load growth will be to reduce rates in the long-term provided that the lower growth *rate is anticipated and does in fact cause a deferment of new capacity.*[1]

The Commission emphasizes that its conclusions with respect to the role and forecast of price are predicated on the "status quo" as far as energy pricing policy is concerned. These conclusions do not reflect the potential implications of any policy changes affecting the manner in which B.C. Hydro rates are determined.

Various intervenors made submissions with respect to rate structure and rate policy at the hearings, particularly during the Vancouver sessions. However, given the terms of reference of this review, the Commission does not believe it is within its mandate to make recommendations on these matters.[2]

In the end-use/engineering methodology used by Hydro and the Ministry of Energy, Mines and Petroleum Resources, energy prices do not play an explicit role. Rather, they are taken into account implicitly in the development of certain fuel share and energy-use coefficients and assumptions. For example, in estimating the number of households that will use electricity as opposed to natural gas for space heating, relative fuel prices are considered.

Hydro argued that the conservation allowance in its forecasts are driven by (and therefore take account of) future price changes. Whether this approach adequately and fully takes price change into account is unclear. In its September 1982 forecast, Hydro attempted to quantify the implicit price effects, by relating the reductions in demand attributed to conservation in the residential and commercial sectors were related to the projected increase in electricity prices. On the basis of these calculations, Hydro argued that the implicit price effects in its forecast seemed reasonable. However, it is not clear how much of Hydro's conservation allowance should be attributed to B.C. prices when much of it clearly relates to appliance and other improvements resulting from North American price increases. Hydro's conservation allowance declined from the September 1981 to September 1982 forecast even though its forecast of real electricity prices increased. The role that B.C. prices in their own right have in the forecast was left uncertain (110:18,083).[1]

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[1] The Commission does not accept the concept of the "death spiral" mentioned at the hearings, whereby lower demand would cause a never-ending spiral of higher prices and further reductions in demand. As explained above, reduced growth will in fact reduce rates in the long term by deferring the need for new (expensive) capacity.

[2] For further discussion, see Chapter XX.

For the bulk sector forecast, Hydro "asked the people responsible for the various sectoral analyses to [provide an estimate] of the impact of a change in the electricity prices on the electrical requirements" (108-17,705). Hydro's consultants indicated that the prices Hydro was forecasting would not have an effect. Indeed, in some sectors, despite the projected increases in price, the electrical use per unit of output was forecast to increase because of technological changes. The conclusions in the NERA report that price has a significant impact on industrial demand was, in Hydro's words, "abandoned...in this forecast" (108:17,711).

The Commission concludes that the manner in which energy prices are taken into account in the end-use/engineering forecasts is not completely satisfactory. The Commission concludes that it is not apparent that the rising real electricity prices which can be expected over the next decade have been fully reflected in Hydro's September 1982 forecast.

The role of price in the econometric models is much clearer than in the end-use/engineering forecasts, which is a principal reason for the Commission's recommendation that Hydro include econometric techniques in its future forecasting procedures. However, the manner in which price effects are captured and the role they play depend on the way in which the econometric model is formulated.

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[1] For further discussion see Section 2.3.3 of this chapter.

The two models presented in evidence at the hearings have different structures and, consequently, the price effects they capture would likely be different. In the model presented by Drs. Helliwell and Margolick, energy prices are assumed to affect the type of equipment used to produce goods and services in the economy and impacts on energy demand are assumed to take up to five years to be fully realized.[1] In the Datametrics model filed by Hydro, energy prices in the nonresidential sectors are not assumed to affect the type of equipment, but rather the mix of energy and labour used to produce goods and service. The impacts captured here would likely be much more short run in nature (Ex 432 : B-2).

The Commission recognizes that using an econometric model does not guarantee that price effects will be adequately taken into account and that great care must be taken in formulating the model in order to capture both the short and long-term impacts of price. For planning purposes, the long-run effects are of central concern. The econometric model filed by Hydro does not appear to deal adequately with the long-run impacts of changing energy prices.

2.3 Other Forecasting Issues

A number of specific forecast issues were explored extensively at the hearings, including industry outlooks, technological change, conservation, interfuel substitution, and self-generation of power.

2.3.1 Industry Outlooks

In the end-use/engineering approaches of Hydro in its September 1982 forecast and the Ministry of Energy, Mines and Petroleum Resources in its 1981 forecast, the bulk and industrial sector forecasts were built up from individual forecasts for each of the major industries in British Columbia.

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[1] The models reviewed by NERA indicated that price impacts would take up to 10 years to be fully realized (Ex 32 : 2).

In cross-examination of the Ministry's forecast one major area of controversy related to the primary metals and mining industries---the number and timing of new copper, lead-zinc, ferro-silicon and aluminium smelters in particular. Projected growth in these industries was responsible for a significant increase in the Ministry's forecast of electricity requirements in its 1981 forecast as compared to its 1980 forecast. The Ministry panel agreed that some of the assumptions in these areas, for example, those with respect to ferro-silicon smelters, may have been overly optimistic (10:1,602).

In cross-examination of Hydro's September 1982 forecast, the overriding issue was whether, as with GPDP generally, the industry outlooks were overly optimistic. In the forestry industry, for example, Hydro's outlook anticipated strong recovery in 1983 and 1984, namely, real growth in value added of 20.2% and 32.0%, respectively, with major expansions in capacity from 1986 until the mid 1990's with seven new chemi-thermal mechanical pulp mills over that period. The strong short-term outlook in the forestry sector was questioned in view of soft markets in the U.S. and the threat of trade barriers. The timing of expansion in pulp and paper capacity from 1986 onwards was also questioned in view of the industry's current and near-term financial constraints.

In the coal mining industry, Hydro anticipated that all existing mines and mines under construction would reach full capacity by 1990. The metal mining outlook used by Hydro included what its consultants termed tentative as well as firm prospects (Ex 429:5-11;5-19). For the petrochemical sector, Hydro's industry outlook assumed that a liquefied natural gas plant, a natural gas liquids extraction plant, an ethylene and derivatives plant, and an ammonia/urea plant will all come on-stream between 1986 and 1992 (110:18,031-38).

The Commission concludes that the industry outlooks used by Hydro as the basis for its bulk sector and general industry load forecasts reflect maximum rather than "probable" forecasts. This was also the case with some of the outlooks used in the Ministry's 1981 forecast. These maximums may ultimately be realized in British Columbia, but given current conditions and the prospect of a slow recovery, the Commission concludes that they are unlikely to be realized as fast as Hydro suggests.

2.3.2 Technological Change

In addition to assuming rapidly improving economic conditions, Hydro's September 1982 forecast assumes a significant shift into more electricity-intensive processes. This is particularly pronounced in the forestry sector where Hydro, on the basis of its consultant's reports, is projecting a major shift into thermal and chemi-thermal mechanical pulping (TMP and CTMP). Hydro projects that new growth in TMP and CTMP will account for 2,400 GWh, or 73%, of the total load growth in the forestry sector (Ex 429:C-21;5-6).

According to Hydro's consultant, the shift is -

> pure technological change, which is prompted by shortages in fibre in Scandinavia, and it is becoming of interest to North American producers because of emerging fibre supply problems, and a desire to produce the maximum out of available wood supply (109:17,900).

Hydro also anticipates a shift to more electric-intensive processes in coal mining. Though of far less significance to the electricity load forecast than the process shift in forestry, nonetheless a 20% increase in electricity requirements per unit of output is assumed (110:18,020).

The central issue concerning these process changes is whether they will take place despite the rising electricity prices projected by Hydro. Hydro witnesses argued that they will because of the relatively small proportion of total costs accounted for by electricity. In forestry, for example, wood supply costs are a major concern; the economics of processes that reduce these costs by improving utilization will, according to Hydro's consultants, not be greatly affected by higher electricity prices.

The Commission accepts that technological change, particularly in the forestry sector, is potentially an important factor in the growth of the future electricity requirements in the province. However, the Commission concludes that because of the economic outlook, current financial constraints and rising electricity prices, new capital investments into more electricity-intensive processes may take place less extensively or less rapidly than Hydro has forecast.

2.3.3 Conservation

In Hydro's September 1981 and September 1982 load forecasts, an allowance for conservation was factored into the estimates of residential and general sector requirements. The allowances were based on research undertaken by Hydro's Energy Conservation Division.

Hydro stated that energy pricing plays a major role in determining the extent of energy conservation. "The amount that we deduct from our forecasts in conservation is really to a large extent price derived" (2:164). Hydro's conservation allowances in its September 1981 and September 1982 forecasts, as shown in Table 7, appear to conflict with that statement since the allowances are lower in the September 1982 forecast though higher prices are now projected.

TABLE 7

Hydro Conservation Allowances Probable Forecasts[a] (GWh)

	September 1981	September 1982
Residential		
Sector Allowance	1,700	1,150
General Sector		
Allowance[b]	2,300	525

[a] Allowance in 1991/92 for 1981 forecast; 1992/93 for 1982 forecast.

[b] Conservation allowance for September 1982 is for commercial floor space only and therefore not directly comparable with that of 1981.

Source: Ex 416 and Ex 429

With respect to the residential sector conservation allowance in the September 1982 forecast, Hydro acknowledged that much of the conservation effect related to imported appliance efficiencies; it was not clear if Hydro allowed for any conservation due to B.C. prices and conditions (108:17,567). Hydro also acknowledged a sharp increase in average use for the "other" appliance category (eg., hot tubs, T.V. games, etc.), which comprised a large share of the residential load. Hydro testified that its estimates of average use for this "other" category were uncertain (109:17,745-9). With respect to the general sector conservation allowance in the 1982 forecast, Hydro estimated conservation only for electrical use in new buildings. (110:18,058).

Questions were raised at the hearings about the future potential for conservation, given the amount that has already taken place. Hydro's conservation specialist suggested that the potential for conservation was vast.

> We found no indication yet of any limitation on energy conservation ... there is by no means anything close to even 50 percent of the houses in the Province that are insulated up to their maximum ... [in] the industrial and particularly the commercial sector, there are very few enterprises which have yet to take substantial advantage of energy conservation... I see absolutely no reason to see any dampening in conservation until well after the turn of the century. (3:362-3)

The Commission believes that it is important to distinguish two quite different aspects of conservation. One is the general effect of price on conservation. The other is the effect of regulatory standards, education programs, and other special measures on how quickly and to what extent economic conservation measures are adopted. The Commission believes that for forecasting purposes the effect of price on conservation should be treated as part of the explicit role of price. The second aspect could be treated as a special conservation allowance insofar as special measures or programs are in place that will increase the responses to higher prices over and above what could normally be expected. Hydro's present treatment of conservation does not adequately separate these two phenomena and future forecasts should address this.

The Commission concludes that the methods employed by Hydro to derive conservation allowances, particularly since they are assumed to capture price as well as program-induced effects, are inadequate. The magnitude of the allowance in both the residential and commercial sectors and the absence of any allowance in the industrial sector, suggest that conservation has not been fully taken into account in the 1982 forecast. THE COMMISSION RECOMMENDS THAT HYDRO BE DIRECTED TO IMPROVE ITS TREATMENT OF CONSERVATION BY BETTER INTEGRATING IT INTO ITS LOAD FORECASTING.

2.3.4 Interfuel Substitution

Interfuel substitution refers to the shift from one type of fuel to another in specific end uses, like space heating, where the basic energy requirement can be met by a variety of fuels.

In both Hydro's and the Ministry's forecasts, the extent of interfuel substitution is derived from assumptions concerning conversion rates of existing housing stock and fuel capture rates for new dwellings. In the econometric models, it is usually derived from explicit fuel share equations. In both types of approaches, relative fuel prices and fuel availability are the key determinants of shifts in fuel use.

In Hydro's 1981 and 1982 forecasts, the price ratio of natural gas to electricity was assumed not to exceed the 75-80% level on an efficiency-adjusted basis. Consequently, the current price advantage of natural gas was assumed to continue. No assumptions were made with regard to the timing and implications of replacement cost pricing for all fuels. Hydro assumed natural gas would be extended to Vancouver Island in both its 1981 and 1982 forecasts resulting in a reduction of electricity's share of the provincial market.

Hydro said that it will be able to do a better job on interfuel substitution when it develops a satisfactory procedure for making total energy forecasts (109:17,829). In particular, the assumptions regarding competing use of electricity and natural gas will be more fully refined in the context of such a forecast.

The February 1980 provincial energy policy statement contained two important directions for energy pricing and supply that are relevant to Hydro's fuel share assumptions. First, it indicated that energy prices should move toward long-term replacement costs. Second, it indicated that natural gas should play a significant role in reducing our dependence on oil through the conversion from oil to natural gas and through the extension of natural gas service to parts of the province where it is economically viable.

The Commission concludes that the issue of interfuel substitution ought to be given more explicit consideration in future forecasts. THE COMMISSION RECOMMENDS THAT RELATIVE PRICES AND POLICIES REGARDING COMPETING FUELS BE CAREFULLY AND EXPLICITLY ANALYSED WITHIN THE CONTEXT OF A B.C. HYDRO TOTAL ENERGY FORECAST.

2.3.5 Self-generation

Self-generation of power is possible in a wide range of industries, including forestry, metal mining and smelting, coal mining and petrochemical activities. Self-generation has a direct bearing on Hydro's requirements since the more power supplied by industry, the less need be supplied by Hydro. The issue raised at the hearings was whether the amount of self-generation in the province will be greater than that assumed by Hydro in its projections.

In particular, questions were raised about whether self-generation is likely at new coal mining and petrochemical operations (no self-generation was forecast by Hydro), and how much self- or co-generation will occur in the forest industry.

Wood wastes or hog fuel from forestry operations provide significant potential for thermal power production. Two types of hog fuel-fired thermal generation were identified : single extraction condensing generation and noncondensing or cogeneration. The former is similar to conventional utility-type thermal operations while the latter produces electricity as a by-product of the pulping process (Ex 85C : 2-3).

Hydro's forestry consultants estimated that in 1982, some 2,300 GWh of electricity would be self-generated by the forestry industry. Hydro suggested that the potential for further increases is limited, and included only some 600 GWh of potential additional cogeneration in its September 1982 forecast (Ex 435). Hydro's forestry consultants indicated that this limited potential stemmed from three factors: (i) the trend to thermal mechanical pulp which, if sold as market pulp, requires no steam and reduces hog fuel supply; (ii) the rapid increase in the price of turbogenerators and cost of construction and installation; and (iii) large increases in the cost of transporting hog fuel (Ex 430).

Drs. Helliwell and Margolick testified that their studies suggest an additional 288 MW of cogeneration capacity, capable of generating 2,250 GWh per year in the province is economic given Hydro's current purchase pricing policy.[1] If prices were based on the marginal cost of new electricity in the province, they estimated that 411 MW, capable of generating 3,200 GWh, would be economic.

In addition to economic considerations, certain institutional factors prevent the realization of this potential. These factors include Hydro's current rate structure and purchasing policy, and the financial advantages available to Hydro but not to private industry. Of particular concern were the following factors, which may inhibit the development of economic self-generation facilities (Ex 85C):

- Hydro's existing rate structure, featuring relatively high capacity or demand charges and significant stand-by charges, reduces the incentive to industry to produce electrical energy by cogeneration since such production does not diminish the requirement for 'standby' availability from Hydro.
- The low purchase price offered by Hydro reduces the incentive to install cogeneration capacity in excess of the producer's own requirements.
- The much lower cost of capital available to Hydro, due in large part to the government's guarantee which allows Hydro to finance almost entirely by debt, provides a large cost advantage to Hydro compared to industrial suppliers of power.

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[1] Hydro currently will purchase surplus electrical energy from industry at the trailing block industrial rate.

The Commission recognizes that these institutional factors may be important impediments to the development of self-generation generally and cogeneration in the forestry industry specifically. To the extent additional cogeneration potential is realized, Hydro's load forecast could be further reduced. However, the evidence presented at the hearings does not allow the Commission to determine how much additional cogeneration can be expected or is desirable.

3.0 ELECTRICITY EXPORTS

The Commission heard a considerable amount of evidence about export market conditions and electricity export policy in British Columbia. Witnesses for Hydro testified that the utility does not plan to export power but simply to meet the projected domestic load at all times, even if critical water conditions prevail. If water conditions are above the critical run-off level, or if load requirements fall short of forecast levels then an exportable surplus arises. In recent years, Hydro has had, on average, a substantial exportable surplus, which has been sold to the United States. Indeed, high water conditions plus relatively low provincial demand in 1981/1982 allowed Hydro to realize $249.3 million of electricity export sales, mainly to the California market (Ex 47 : 3).

In his appearance before the Commission, the Hon. R.H. McClelland, Minister of Energy, Mines and Petroleum Resources, confirmed that "the government policy and Hydro's are concurrent ... and that the government policy is that we do not build for firm export in British Columbia ... and it has been the opinion of the B.C. Hydro Board at this time — that Hydro does not build for firm exports." (24 : 4,062). The Minister also indicated that the provincial government's policy regarding interruptible export is the same as for firm exports (24 : 4,064).

Nevertheless, surplus electricity exports have been very important in recent years and have an important bearing on the economic implications of overbuilding (see Chapter VIII, Section 3.2). At the request of the Commission, a Seattle-based consulting firm prepared a report on the market potential for power exports to the United States (Exhibit 13). Two market regions were identified: the Pacific Northwest (PNW) and the Pacific Southwest (California).

The consultant concluded that if both British Columbia and the PNW pursue a strategy of self-sufficiency in electricity even during low water years, then it is highly unlikely that Hydro will have either short- or long-term sales opportunities in the PNW: "... utilities of the Northwest are not going to abandon or defer their own construction program on a hope that British Columbia is going to have surplus power on a day-to-day or month-to-month basis" (II:1,826). Only if an imbalance between demand and supply occurs — a planning failure — might such a market exist. While Hydro suggested such might be the case because of the delays and cancellations of new projects, the consultant for the Commission indicated that, while new supply in the PNW is being deferred, "one of the most important reasons... is because need is being deferred" (12:1919). The consultant cautioned that "it's not clear what the combined impact of slowing demand growth and (delayed) construction schedules will be ..." (12:1912).

Export markets are relatively weak now and are expected to remain so until 1988/1989 (III:18,151-2). This is due in part to forecast weak demand in the region: the most recent Bonneville Power Administration forecast projects an increase of only 1.6% per year over the next 20 years. This not only affects direct sales into the PNW, but is also likely to raise the level of competition in the California market.

Further complicating the export situation for B.C. Hydro is the effect of fluctuating water conditions in the PNW. Average and high water conditions can increase the PNW annual surplus by over 28,000 GWh and 50,000 GWh respectively (Ex 13 : 30). Due to relatively low storage capability in the PNW as opposed to the much greater capability in the B.C. Hydro system, Hydro can adjust its export sales (i.e.: load shape) to periods when the intertie capacity between the PNW and California is not fully utilized (III : 18,153). However, Hydro indicated that the marketing of surpluses will be more complicated and competitive than in the past (III : 18,152).

The long-term outlook, in Hydro's view, remains strong. By 1994, California will have an estimated 50,000 GWh of oil or gas-fired generation and will need, in addition, some 30,000 GWh of import or exchange power. Under such circumstances, the prospects for more attractive surplus sales or long-term firm contracts of 10 years or more will be very good. Moreover, Hydro is optimistic that the intertie capacity will be expanded over the long term with the removal of institutional and economic impediments (III : 18,165-172). This expansion will facilitate "potential mutual benefits as far as energy management on the west coast is concerned" (III-18171).

The Commission concludes that there is and will continue to be a market for surplus power in California, and that with Hydro's load shaping capability, intertie capacity should not impose too great a constraint on reasonable volumes of sales. But the value of these sales will depend on trends in world oil and gas prices and on the extent of electricity surpluses in other regions, both of which appear likely to constrain export prices at least through to the late 1980's.

4.0 OVERALL ASSESSMENT OF HYDRO'S DEMAND FORECAST

The Commission concludes that the growth in demand that Hydro is facing in British Columbia and the potential demand in the United States will be relatively weak for the balance of the decade. As a result of any of the following factors — lower GPDP growth than Hydro has projected; the effect of rising real electricity prices; less rapid shifts into electric-intensive processes; more conservation or alternative energy substitution for electricity; greater realization of self-generation potential — a lower rate of growth than shown in Hydro's September 1982 10-year probable load forecast could very easily result. The Commission therefore concludes that Hydro's "probable" load forecast should be considered as optimistic, and that offsetting export demand for surplus energy at attractive rates is not likely for the balance of the decade.

CHAPTER VIII - ELECTRICAL ENERGY SUPPLY

1.0 B.C. HYDRO'S SUPPLY POLICY AND ANALYSIS

Each year after the load forecast is prepared, Hydro develops an electrical system plan indicating the desired sequence and timing of new projects for the following 10-year period. The system plan is based on a review of the cost, feasibility and earliest in-service date of alternative hydroelectric, thermal and other energy projects. The timing and selection of projects is designed to ensure that the probable load projected in the latest forecast can be met by firm supply at the lowest, long-term cost (27 : 4500).

Hydro explained that supply has two aspects: the ability to meet the highest demand experienced at any time throughout the year (peak load) and the ability to meet total annual electrical energy requirements. Because Hydro's system consists largely of hydroelectric generating stations with capacity designed to take advantage of fluctuating water flows, new generating facilities are not required to meet forecast peak requirements (27 : 4,516). "The need for new power plants over the next decade will therefore be determined by the need for more firm energy [annual capability] rather than the need for additional peak generating capacity" (Ex 25 : 8-7).

Hydro defines firm energy capability as the sum of "hydroelectric plant output available during critical water conditions... [plus] the Burrard Thermal Plant operating at about 40 percent annual capacity factor fueled by off-peak valley natural gas[1]... [plus] other thermal plants [that may become part of Hydro's system] operating at annual capacity factors of 60 to 80 percent, depending on type, size and maturity... [plus] any firm purchase contract" (27 : 4,513-15). When the probable forecast load exceeds the supply from these sources, Hydro's criterion indicates a new plant is required.

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[1] Off-peak valley gas refers to the supply available during the non-heating season when the transmission facilities are not fully utilized.

Hydro estimated that when Revelstoke is fully in service its annual firm energy capability will be 45,700 GWh (Ex 103). Based on its September 1981 probable load forecast, Hydro stated that "the optimum timing for another project [after Revelstoke] would be the fall of 1987" (27:4,512). In the system plan which Hydro proposed at that time (summarized in Ex 103), the Site C project was scheduled for October 1988[1] because that was considered to be its earliest feasible in-service date (27:4512).

Hydro testified that Site C was selected over all other projects because it was "considered to be the lowest cost project with a significant energy capability that could be brought on line by 1988. The only major alternative to Peace Site C would be the Hat Creek thermal project" (27:4,524). Hydro estimated that the total system costs of an expansion sequence that would produce an additional 1,000 megawatts out of Hat Creek instead of Peace Site C would entail a total discounted cash flow approximately one billion dollars greater than the recommended plan, based on a real discount rate of 3% (27:4,525). (Hydro uses a 3% real discount rate in its system plan evaluations because 3% reflects the estimated real long-term cost of borrowing. In other words, it is the direct real cost of capital to Hydro.)

Hydro did not submit a system plan based on its September 1982 load forecast. During the re-opening of the demand phase at the end of the hearings, Hydro indicated that the Site C project is still necessary and justified. However, because of the lower rate of growth in its later forecast, Hydro indicated Site C would not be needed until October 1990. As shown in Table 8, a deficit of 1,360 GWh is forecast in 1990/91 if no new sources of supply are made available.

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[1] Units #1 and #2 were scheduled for 1988; units #3 through #6 were scheduled for 1989.

Despite the later in-service date, Hydro suggested that the granting of the certificate and start-up of construction should not be delayed because, while Site C could be constructed over a six-year period, economies might be realized by extending the construction period (III:18,190-2). Therefore, Hydro asked that a certificate be issued and construction be allowed to begin in the spring of 1983.

TABLE 8

Energy Supply/Demand Balance
Integrated System
(GWh)

	September 1982 Probable Load	Firm Supply	Firm Surplus or (Deficit)
1982/83	32,400	40,020	7,620
1983/84	34,150	42,020	7,870
1984/85[a]	36,130	45,700	9,570
1985/86	37,875	45,700	7,825
1986/87	40,100	45,700	5,600
1987/88	41,920	45,700	3,780
1988/89	43,440	45,700	2,260
1989/90	45,120	45,700	580
1990/91	47,060	45,700	(1,360)
1991/92	49,330	45,700	(3,630)

[a] Assumes Revelstoke fully on-stream by 1984/85.

Source: Ex 416, Table E8; Ex 103, Table 2.

2.0 THE ISSUES

The principal issues with respect to electrical energy supply relate to when new generating capacity is required and whether Site C is the best source of new supply.

2.1 Supply Assumptions

To determine when new supply is required, Hydro compared its "probable" load forecast with its estimate of firm supply. Questions were raised about the manner in which firm supply is defined and about the non-firm sources of supply that might be available to Hydro. The basic issue was whether the need for new facilities is exaggerated as a result of overly cautious or narrow assumptions regarding supply.

2.1.1 Definition of Firm Hydroelectricity Supply

Hydro defines firm hydroelectric capability as the amount of electricity it can produce from its hydroelectric plants under critical water conditions. Critical water conditions refer to a sequence of low water run-off years (specifically, those experienced between September 1942 and April 1946) which would reduce the capability of the hydroelectric plants by about 4,000 GWh per year from their capability under average water conditions (28 : 4,705; 31 : 5,382). This 4,000 GWh is approximately three times the 1990/91 deficit for which Hydro states new supply is needed.

Hydro indicated that the large, live storage capability of Williston to supplement low water conditions is used in its critical water year assumptions (30 : 5,244). Hydro is not concerned with a single low water year, but with a sequence of low water years. With respect to the probability of such an occurrence, Hydro stated that "over a period of... about 50 years, we've experienced three, four to five year low flow conditions, and so on the basis of experiencing these in the last 50 years ... our estimate of the chance of that recurring ... is about 15 percent" (29 : 5,060). This probability is not based on a frequency distribution of water conditions, but rather is inferred from historical occurrences. Hydro stated that when looking at a series of years as opposed to one individual year "there is just really no way that we can see that you can accurately, through statistics, represent [the] kind of distribution [that has actually occurred]" (29 : 5,059).

Hydro plans on the basis of critical water conditions because at some point in the future such conditions will recur. Hydro agreed that only in the last year of a low water sequence do "you finally draft all your storage"; any time before that something more than the firm capability could be produced. However, Hydro stated this could only be done at the risk of a tremendous deficit if that low flow sequence continued. (31 : 5,407-8). Thus, while one might reach the last year of a critical sequence in only three or four years out of 100, there may be "12 to 15 years out of 100 [when] you can only serve the [firm capability] load... on a prudent basis" (27 : 5,410).

The Commission concludes that the risk of critical water conditions is real and clearly should be taken into account in system planning.

Hydro's planning criteria uses critical water conditions to determine when a new project is required. While this results in surplus generating capability most years, the Commission concludes it is a necessary and prudent safeguard against supply shortfalls in low water years. This is specifically endorsed in the province's February 1980 statement on energy policy (Ex 46 :10).

However, as the costs of new supply are very significant, other methods of dealing with critical water years warrant careful consideration. One such alternative method, a planning agreement with Alberta, is discussed below. Whether such alternatives are feasible or economic is presently unclear. They *should be examined. If they are shown to be feasible the need for a new project could be deferred significantly. THE COMMISSION RECOMMENDS THAT HYDRO BE DIRECTED TO GIVE PRIORITY TO INVESTIGATING THESE ALTERNATIVES AS A MEANS OF MODERATING ITS FIRM HYDROELECTRICITY SUPPLY CRITERIA.*

2.1.2 Availability Of Burrard Thermal Plant

In calculating firm supply, Hydro limits the firm energy capability of the Burrard thermal plant to the amount it can produce with off-peak valley gas. This results in a firm load factor of approximately 40%. If Burrard were operated year round at its maximum load factor of 70%, it could produce 5,595 GWh per year, which would provide an additional 2,425 GWh more than Hydro includes in its estimate of firm supply (Ex 25 : 2-9).

But Hydro claims that operating Burrard year round would be expensive and problematic. Year-round production would necessitate contracting for a large amount of gas, which the province might not want to dedicate to thermal generation (29 : 5,044). Furthermore, Hydro would have to provide Westcoast Transmission Co. Ltd. at least 18 months notice and enter into a take-or-pay[1] contract for the additional gas Burrard would require. This could be a problem because Hydro's NEB export licence stipulates that exports of electrical energy generated at Burrard must realize a price equivalent to the gas export price. At the time of the hearing this was approximately 60 mills per kWh, "which ... would probably freeze us out of the export market" (31 : 5,267). Finally, because Burrard has not been used recently as a base load plant, operating at a 70% load factor could be difficult, at least in the first year (32 : 5,470-1).

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[1] A take-or-pay contract refers to an obligation to pay for the contracted volumes regardless of whether the gas is taken or not.

The economics of using Burrard depend on the discount rate (cost of capital) and the value of B.C. natural gas. In cross-examination, Hydro agreed that at an 8% real discount rate and with gas valued at its domestic price, additional electricity supply from Burrard would be less expensive than new supply from Site C (30:5,212). Hydro pointed out, however, that Burrard would be a more expensive source of supply at a 3% discount rate or with natural gas valued at the export price. Hydro uses a 3% discount rate for its evaluation of direct costs and considers the export price as the appropriate measure of the value of gas from a social point of view (Ex 21:2-3).

The Commission recognizes the problems Hydro would have in operating Burrard year round. At the same time, the Commission is concerned that ignoring the additional 2,425 GWh of electricity that Burrard can produce might result in overstating the need for additional electricity supply in British Columbia. Given the relatively small supply shortfall Hydro now forecasts for 1990/91, greater use of Burrard by itself could defer the need for a new project for about one year. Hydro itself noted the possibility of using Burrard to a greater extent when it discussed possible shortfalls in its December 1981 system plan (Ex 103:1).

In two important respects, the issues governing the economic attractiveness of greater use of Burrard go beyond Hydro's area of responsibility. The value of capital (the discount rate) and the value of natural gas (its opportunity cost) from a social point of view are matters that only the government can address. THE COMMISSION RECOMMENDS THAT THE GOVERNMENT PROVIDE SPECIFIC POLICY DIRECTION TO HYDRO ON THESE KEY FACTORS WHICH UNDERLY THE ECONOMICS OF OPERATING BURRARD. Only with such direction can the role of Burrard in Hydro's supply planning be properly assessed.

2.1.3 Availability of Imports Through the Alberta Intertie

Questions were raised at the hearings about the possibility of acquiring electrical energy from Alberta through the recently approved Alberta (Cranbrook) Intertie. In support of its application for approval of the Intertie, Hydro officials stated that 5,000 GWh of Alberta supply might be available over a four to five year period in the late 1980's.

While Hydro officials at the Intertie hearing stated that one advantage of the tie would be to "fill reservoirs during low flows", Hydro does not "consider the tie a credit in firming up our energy supply" (30:5,183). Under the now existing Intertie agreement there is no commitment for firm power sales by any of the parties.

The Commission heard evidence on the benefits that could be derived from inter-regional planning agreements (111:18,164). It is important to determine whether such benefits could be realized from planning agreements with Alberta utilities. The well-known advantages of operating a hydroelectric system, which is constrained by the possibility of low water conditions, in conjunction with a thermal-oriented system, which is constrained by peak demand, suggests there could be substantial benefits. With planning agreements, the energy supply capability and capacity of the existing facilities in both provinces would increase significantly.

The Commission concludes that, while the current Alberta Intertie agreement does not provide for firm power sales or purchases, the Intertie could ultimately be important in providing a benefit that Hydro itself identified, that is, it could be a source of thermal power during years of low water flows. THE COMMISSION RECOMMENDS THAT HYDRO BE DIRECTED TO CONSIDER AND PURSUE A PLANNING AGREEMENT WITH ALBERTA UTILITIES AS AN ALTERNATIVE METHOD OF DEALING WITH CRITICAL WATER YEARS.

2.1.4 Availability of Alcan Power

In cross-examination, Alcan was identified as a potential source of supply. Hydro currently purchases 1,200 GWh per year from Alcan, but the agreement runs out in 1983; consequently, no Alcan purchase is shown in Hydro's estimate of firm supply beyond that date (30 : 5,218-9).

Hydro is currently negotiating with Alcan for purchases beyond 1983. Hydro agreed that Alcan has no other potential buyer of its surplus power, but it pointed out that Alcan is considering modifying its existing pot lines which would use up its surplus power, and that Alcan appears to be willing to negotiate only on a year-by-year basis from 1983 (30 : 5,220). The power under negotiation relates only to surplus from Alcan's existing plant; no assumptions have been made with respect to the proposed Kemano project (30 : 5,220).

The Commission concludes that Alcan cannot be considered a firm source of supply at the present time.

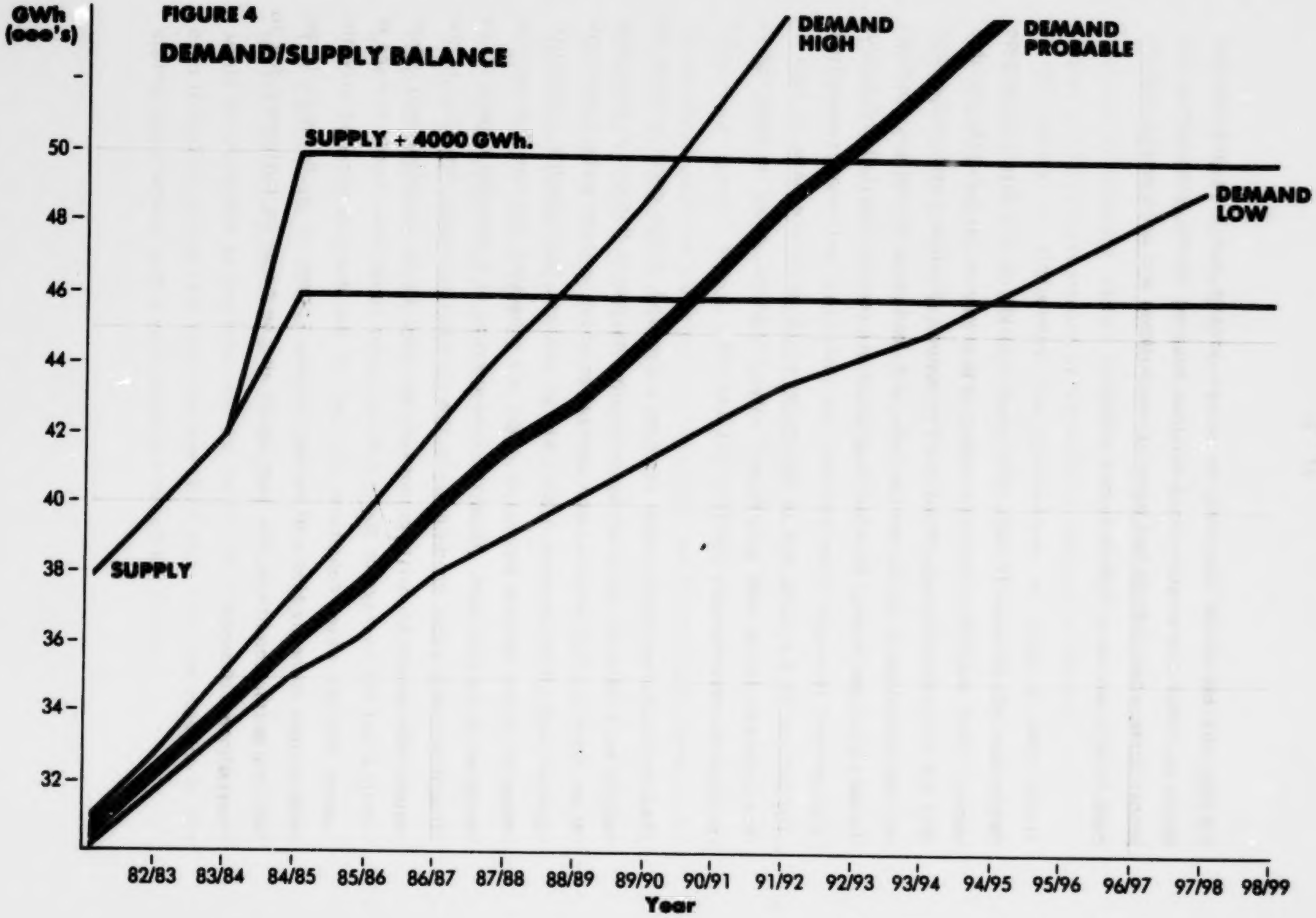
2.2 Consequences and Costs of Overbuilding vs. Undersupply

When Hydro made its application for Site C in September 29, 1980, it estimated that new supply would be required by the fall of 1986. At the outset of the hearings, based on the September 1981 forecast, Hydro estimated that new supply would be required by the fall of 1987. At the final stage of the hearings, Hydro estimated that new supply would be required by the fall of 1990.

Figure 4 shows required in-service dates for a new project, based on alternative demand and supply scenarios. Given its existing firm supply, Hydro's September 1982 high, probable and low projections would indicate required in-service dates of 1988, 1990 and 1994, respectively. Were Hydro able to increase its existing supply by 4,000 GWh as a result of a planning agreement with Alberta, greater use of Burrard, extension of its purchase from Alcan, or some combination of those possibilities, its high, probable and low September 1982 projections would indicate required in-service dates of 1990, 1992 and 1998, respectively.

FIGURE 4

DEMAND/SUPPLY BALANCE



Clearly, the timing of the need for a new project has been and remains uncertain. The Commission concludes that because of this uncertainty, the probabilities, consequences and costs of overbuilding and undersupply must be considered in assessing Hydro's system plans.

Hydro filed a study on overbuilding and undersupply in relation to its September 1981 forecast (Ex 121). The study considered two Site C in-service dates — 1988 and 1989 — and two load-growth scenarios (Hydro's 1981 probable and the Ministry of Energy, Mines and Petroleum's 1981 base case). Depending on the combination of in-service date and load growth, various shortfall (undersupply) and surplus (overbuilding) situations result. Shortfall and surplus management strategies were assumed, and their costs and benefits estimated. The purpose of the study was to determine which in-service date, in light of the uncertainties in load growth and water conditions, could be expected to produce the lowest supply cost (Ex 121: 1-3 to 1-4).

The study assumed that, in the event of a shortfall, Hydro could increase its supply by 3,000 GWh per year by increasing its use of Burrard or importing from Alberta. Additionally, with average or above average water conditions, Hydro could draw on over 4,000 GWh of nonfirm hydroelectric capability. When all of the nonfirm sources of supply are exhausted, the supply to existing users would be curtailed. Thus, the consequences of a shortfall depend on its magnitude and water conditions. In the shortfall scenarios described in the study, the supply to existing users would need to be curtailed only under critical but not average or above average water conditions. Under average or above average water conditions the cost of the shortfall entailed only the extra costs borne by Hydro of having to import power or use Burrard. Under critical water conditions, the cost would also be borne by customers due to curtailments of supply.

The study assumed that, in the event of a surplus, Hydro could export the excess electricity. The amount available for export would depend on water conditions. The cost of the surplus was measured by the real cost of capital incurred by investing earlier than required, less the revenues derived from export sales and costs avoided by not having to burn gas at Burrard.

The results of the over and under supply analysis filed by Hydro were shown for different discount rates and assumed export prices. With a 3% discount rate and 30 mill per kWh export price, they indicated that building for the 1988 in-service date (the earlier year) was better, not only if Hydro's requirements forecast was realized, but even if the lower MEMPR growth rate was realized (31:5,320).

The assumed ability to sell surplus power into the export market is an important factor. Hydro acknowledged that if exports were impossible, undersupply would be preferable to oversupply, and Hydro might consequently modify its planning criteria (27:4,692-3). The advantage of overbuilding compared to undersupply varies directly with the export price (Ex 121:1-5). For the analysis in Exhibit 121, Hydro recommended 30 mills per kWh as an appropriate export price, based on recent experience. During the hearing's supply phase, Hydro suggested that 30 mills per kWh may be conservative and that higher prices might be realized (31:5,329-30). But, during the re-opened demand phase, Hydro indicated that over the past six months, export market conditions had deteriorated, and the average price it received was 25 mills per kWh.

The discount rate is another critical factor. The study showed that building for 1988 would be preferable at a 3% discount rate, but that building for 1989 would be preferable at any rate over 6% (at the 30 mill per kWh export price) even if Hydro's growth rate were realized (31:5,321). Thus the question of the appropriate discount rate is very important to optimal timing.

Hydro stated that from its customer's point of view a 3% discount rate is appropriate because that is its best estimate of its actual cost of capital. However, Hydro indicated that from a social point of view with the opportunity cost of capital taken into account, the discount rate should be 8% (30: 5,208-9).[1]

With capital-intensive facilities like hydroelectric plants, the effect of a higher discount rate is to increase markedly one's perception of the cost of power. For example, using a 3% real discount rate Hydro estimated the marginal cost of Site C at 16.9 mills per kWh; using a 10% discount rate, it calculated the marginal cost at about 40 mills per kWh (31: 5,325-6). Thus, assuming a 30 mill per kWh export price, surpluses can be sold at a profit if the cost of capital is only 3%, but at a loss if the cost of capital is 10%.

Hydro has taken the position that while it tries to time projects to accord with load growth, if it is to err, it is better to err on the overbuilding side. Given the ability to export surpluses and Hydro's relatively low borrowing costs, the consequences of overbuilding have been perceived by Hydro to be relatively minor, certainly less significant than the consequences of undersupply.

The Commission recognizes that undersupply can impose serious consequences and therefore should be avoided if possible. But it also recognizes that, under current circumstances, overbuilding can entail the significant economic costs to the province associated with a mistimed investment. Given the softer export market conditions forecast to prevail throughout the balance of the decade, overbuilding can result in the commitment of a large amount of capital yielding a relatively low rate of return. This return might be sufficient to cover Hydro's borrowing costs (i.e. 3%), but it would not be sufficient to cover the social opportunity cost of

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[1] The issue of discount rates is discussed in detail in Part V of this report. See Chapter XIII, 1.3.

capital (i.e. 8% to 10%). Overbuilding could also result in significant upward pressure on domestic customer rates, as discussed in the next chapter. In light of this, the Commission concludes that overbuilding should be avoided.

Because of the potential for further slippage in demand and the possibility of access to other existing sources of supply, the Commission believes that a situation of overbuilding in the early 1990's could arise if the decision to build new generating capacity is taken too soon. The Commission therefore concludes that Hydro and the government should review the forecast frequently and publicly, if appropriate, to ensure that construction on a new project does not start before it is required. Specific recommendations on this matter are made in Chapter X, where the Commission presents its position on the issuance of an Energy Project Certificate.

2.3 Alternatives to Site C

The justification of the Site C project depends not only on when a new source of supply is needed, but also on the availability and relative merits of alternatives. Evidence was presented and questions were raised at the hearings about conventional and non-conventional alternatives to Site C.

2.3.1 Conventional Alternatives

Given the required in-service date indicated by its September 1981 forecast, Hydro submitted that it had few alternatives to Site C. The Hat Creek project was the only major project that could be built within the same time period as Site C (27:4,639). During the supply phase of the hearings Hydro presented Hat Creek as the one real alternative to Site C. By the end of the hearings, however, Hydro announced that Hat Creek was no longer considered an alternative to Site C and had been dropped from the system plan.

The issue of alternatives is interrelated with timing. While Hydro indicated that Hat Creek was the only major alternative to Site C if the target in-service date were the late 1980's, Murphy Creek/Keenleyside could be considered alternatives if the target date were October 1990; and Stikine/Iskut, Kootenay Diversion and East Kootenay thermal could be considered if it were 1993 (27:4,639-44). Hydro provided some evidence on the relative economics of these projects. Because they are at an earlier stage of study than Site C, the data may be less reliable. Nonetheless, Hydro's evidence, presented in Table 9, shows that all the major alternatives are less costly than Hat Creek and some are slightly less costly than Site C (Ex 147).

TABLE 9

Unit Energy Costs of Potential New Power Projects
(Cost in mills/kWh at Oct. 1981 prices)

	Direct Cost With Taxes	Social Cost Without Taxes			
Discount Rate (Net of Inflation)	3%	3%	6%	8%	10%
Revelstoke	15.1	8.4	15.5	21.2	27.5
Burrard Fuel Cost	25.5	53.6	53.6	53.6	53.6
Peace Site C	20.3	12.7	22.2	29.7	38.0
Hat Creek 2000MW	29.7	27.1	35.0	41.3	48.5
Murphy/Keenleyside	24.9	16.6	28.2	37.2	46.8
Stikine/Iskut	19.9	12.4	21.4	28.6	36.7
Liard	19.1	11.9	20.7	27.9	36.0
Kootenay Diversion	20.2	13.7	21.8	27.8	34.1
East Kootenay	27.0	24.4	30.5	35.3	40.6
Nuclear	25.6	23.3	29.7	34.9	40.8

Source: Ex 147

Notes:

1. All costs are average energy costs at October 1981 price levels for the discount rate shown.
2. Direct cost with taxes includes property taxes and the new water licence fees scheduled for 1984, but deflated to October 1981 prices.
3. Social cost without taxes does not include property taxes, water licence fees or coal royalties because these are only social transfer payments rather than real social costs.
4. Burrard fuel price is based on domestic natural gas prices for the direct cost with taxes, and on export prices for the social cost without taxes.

The Commission notes that, as the need for a new project is deferred, the array of projects Hydro can consider increases. The position which Hydro presented on alternatives based on its September 1981 forecast is no longer relevant. Given the current target date of October 1990 for a new project, it would appear that Murphy Creek may be a feasible alternative to follow Revelstoke in the system plan. If the target date for a new project is delayed further, other alternatives such as East Kootenay Thermal or development of the Stikine might become feasible, depending on the length of the delay of the in-service requirement.

2.3.2 Nonconventional Alternatives

Concern was expressed by some intervenors that Hydro is not emphasizing sufficiently nonconventional alternatives. In its 1982/83 fiscal year, Hydro indicated it will spend approximately $20 million (25-30% of its generation planning study budget) on nonconventional sources, over three-quarters of which will go to its geothermal program; it will spend $2 million on small hydro and other sources (27:4,674). Several intervenors argued that in the U.S. Pacific Northwest much greater emphasis is placed on these sources. Hydro countered that the costs of conventional sources in that region are much higher than here.

Some intervenors argued that Hydro should have considered an expansion plan incorporating small projects. It was suggested that, with shorter lead times, such a sequence might be more flexible and more attractive than the sequence Hydro considered (27:4,587-9; 4,612-3). In response Hydro stated that, like other Canadian utilities, it is unwilling to pin hopes on small projects because they are more costly and are not likely to meet the load (27:4,592). Also, it disagreed that such a sequence would be more flexible and have less impact considering the large number of projects that would be required to replace one project the size of Site C (27:4,587-9; 4,612-3).

When intervenor witnesses were examined on their evidence on nonconventional energy sources (including conservation), they acknowledged that such sources may entail greater costs than Site C. SPEC's witness on energy conservation, for example, agreed that, according to his evidence the cost per annual petajoule[1] saved through retrofitting and solar hot water is roughly $170 million as compared to the cost per annual petajoule of $74 million that Hydro calculated for Site C (32 : 5,529). Intervenors expressed concern that such comparisons do not take all of the social costs into account, though they agreed that large scale energy production from any source would give rise to social costs (33 : 5,684).

Intervenor witnesses also acknowledged that the potential contribution of nonconventional energy sources might not be realized: "obviously the actual amount of energy saved would lie somewhere between zero and that potential" (32 : 5,536-7). However, their basic position is that "those (sources) are available and they deserve far greater attention than they're getting in British Columbia at the present time" (33 : 5,677).

Hydro's position on the cost and potential of specific nonconventional energy sources and its program and policies respecting them are summarized below.

Wind - Hydro stated that wind generation could be competitive with diesel in isolated areas (27 : 4,594). It also acknowledged that costs could come down with mass production, but with costs currently at some 60 to 80 mills per kWh (based on a 3% discount rate), they are unlikely to come down to the cost of Site C (16 mills per kWh based on a 3% discount rate) (27 : 4,689; 4,817).

Solar - Hydro has examined solar projects, such as photovoltaics and the power tower, as alternative sources of utility-supplied power. Cost data are derived primarily from studies in Alberta. While photovoltaics may become less costly, Hydro maintains that it will be uneconomic until well beyond the 1990's (32 : 5,474).

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(1) One petajoule is the equivalent of 277.8 GWh.

Small Hydro - Small hydro is generally defined as less than 15 to 20 MW. In British Columbia most of the identified small hydro sites are in the 5 MW range. Hydro concentrates its search for small hydro sites on Vancouver Island and in diesel districts. Hydro noted that sites located far from the grid and with enough water could be economic (28 : 4,819-21).

Geothermal - A large part of Hydro's alternative energy program is devoted to its geothermal project at Meager Creek. Hydro estimates that geothermal electrical energy costs are about 1.2 times that of Site C (using a 3% discount rate) and it is now trying to prove up the resource to a 55 MW level. Hydro believes that the ultimate potential of Meager Creek might be 1,000 MW, but at present it is unsure of the size of the resource. Hydro maintains that it is too early to include geothermal in the system plan (28 : 4,779-83).

Municipal Waste Generation - Hydro has considered the economics of generating power from municipal waste in the Greater Vancouver Regional District. Its cost data are based on California and Florida projects. While acknowledging that rising land fill costs might improve the economics of this source of power, Hydro estimates that at present it would be about seven times as expensive as Site C (32 : 5,446).

Hog Fuel - Hydro is reluctant to undertake hog fuel-fired thermal power generation, not only because of its relatively high cost, but also because of the problem of assuring a long-term hog fuel supply. The concern is not that the hog fuel won't be available, but that it might be turned to another use (31 : 5,270; 30 : 5,117-8).

With respect to nonconventional energy sources — wind, solar, small hydro, geothermal, wood waste and others — the Commission concludes that, in their present state of development, these alternatives are generally too small and too expensive to have a major impact on supply. Nonetheless, the Commission believes that Hydro should continue its research on these nonconventional sources so it can use them if technological advances significantly improve their relative costs.

The Commission also believes that the government should review its research and development programs and its policies regarding nonconventional sources. THE COMMISSION RECOMMENDS THAT THE GOVERNMENT CONSIDER WHETHER INSTITUTIONAL IMPEDIMENTS TO THE PRIVATE DEVELOPMENT OF THESE SOURCES MIGHT BE REMOVED OR LESSENED. While it may not appear profitable for Hydro to develop these sources, interest by others might increase with appropriate financial, wheeling[1] *and purchase pricing policies.*

2.4 Evaluation Methods

Lowest long term system cost based on engineering economic analysis is the principal criterion which Hydro employs to select new projects. In engineering economic analysis, all of the costs facing Hydro are estimated over the planning period and then discounted at a rate which reflects Hydro's estimated real cost of borrowing. It is, essentially, a long term private (corporate) analysis. Hydro stated that it uses this criterion because "that's what we are directed to do by our Board ... it helps them to choose the [most economic] project that will meet the demand" (28:4,713).

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[1] Wheeling refers to the transmission of power from the producer to a third party buyer.

Some intervenors expressed concern that projects are selected for technical study prior to detailed evaluation of environmental costs. The intervenors suggested that environmental costs are evaluated only secondarily to engineering cost (28:4,718). Hydro stated that the only costs which enter the engineering evaluations are the estimated mitigation costs which Hydro would have to pay. Impacts outside of those costs are not incorporated into the evaluations (27:4,679).

Concern was also expressed that cumulative environmental and social impacts are not taken into account in the evaluation of a whole sequence of projects.

The basic issue underlying these concerns is whether engineering economic analysis as practiced by B.C. Hydro provides a sufficiently broad basis for ranking projects and developing system plans in terms of the general public interest. Engineering economic analysis evaluates projects from the point of view of Hydro and its customers. Social benefit-cost analysis, on the other hand, "analyzes the value of building the project from the provincial perspective ... it extends [the analysis] to the explicit evaluation of environment effects and the potential diversion of capital for other uses" (27:4,503-4). The issue is really what perspective Hydro should take in developing its plans---a private or social one.

Hydro undertakes social benefit-cost analyses for its licence and certificate applications, but not to determine its own preference for the next best source of supply. "If the social benefit-cost analysis would produce a different result from the engineering economic or corporate financial analysis, Hydro's preferred course of action would remain the same" (31:5,276).

The Commission concludes that evaluation of projects based on the lowest long-term system cost to B.C. Hydro is likely to yield different results than evaluation of the same projects taking full account of resource losses and other social as opposed to private (Hydro) costs.

Hydro's Board of Directors has traditionally interpreted the Corporation's mandate to be to minimize long-term costs to customers. The Board has instructed Hydro management to pursue policies to achieve this result. The evidence during the hearing made it clear that the Board's instructions to management have not changed and still encourage, indeed require, management to evaluate projects based on the least cost to the customer.

The Commission concludes that, to avoid a basic inconsistency between the criteria Hydro uses to select and evaluate projects and the social benefit-cost which the government has indicated as appropriate for this review, either Hydro's evaluation policies or the government's criteria must be changed. THE COMMISSION RECOMMENDS THAT THE GOVERNMENT RESOLVE THIS IMPORTANT MATTER AND ADVISE HYDRO OF THE POLICY TO BE FOLLOWED FOR FUTURE PLANNING AND FACILITY APPLICATIONS.

2.5 Site C Benefit-Cost Analysis

While Hydro bases its project selection and system plan on its engineering economic criterion, it did undertake a social benefit-cost analysis of the Site C project to determine if it would be justified from a social point of view.

The analysis, which is presented in Exhibit 106, entailed a comparison of the estimated full social costs of Hat Creek with the estimated full social costs of Site C. Hat Creek costs were used as the measure of the benefits of the Site C project, on the assumption that if Site C were not built Hat Creek would have to be in order to meet the incremental demand. The difference between the costs of the two projects served as the estimate of the net social benefits of Site C.

Issues related to the social benefits and costs of Site C were raised throughout the hearings and were considered by many as a focal point for the whole question of project justification. Hydro argued, based on its analysis, that the net benefits of Site C are positive and therefore the project is justified - efficient - from a social as well as its own private point of view. The validity of Hydro's analysis and conclusions, however, were questioned. Specific areas of concern were as follows.

Method of Measuring Benefits - In its analysis, Hydro used what is termed in the province's Guidelines for Benefit-Cost Analysis, the 'most likely alternative' method of measuring benefits (Ex 122 : 23-25). Under this method, the benefits of one project are measured by the costs avoided by not having to build another.

The problem with this approach is that while it can be used to determine whether one project is better than another, it does not by itself indicate whether either project is beneficial on any absolute or stand-alone basis. In other words, it does not establish "that society values the project by an amount which is at least as great as the cost of constructing it." (Ex 122 : 24).

Hydro argued that the existence of demand testifies to the social worth of electricity. Its benefit-cost analysis therefore takes the forecast of future consumption as given and tries to determine "the best way of serving that amount of consumption" (27 : 4,662).

A witness for SPEC submitted that, by using an estimate of consumers' willingness to pay for additional power, he found that society does not value the output of Site C by as much as its cost (Ex 400). However, this conclusion was based on the assumption that the output of the project would not be required for five to eight years after it was built. If the output were required, his analysis shows that the value of the output would exceed the costs at discount rates of just under 10%.[1]

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[1] In Exhibit 400, the net benefits (in millions of dollars) of Site C were estimated at -383, -469, and -520 at discount rates of 6%, 8%, and 10%, respectively. If the output were purchased starting in the year the supply was first available (that is, the demand was correctly estimated), the net benefits (in millions of dollars) would be 493, 120, and -95 at the 6%, 8%, and 10% rates (Ex 400 : Table I).

The provincial Guidelines suggest that the issue of the value of the output "focusses attention on demand estimation and forecasting". This, in effect, is what Hydro's benefit-cost witness and the findings of SPEC's witness indicated.

Choice of Alternative - In order to use the alternative cost method of measuring benefits, the best feasible alternatives must be considered. During the supply phase, Hydro defended the use of Hat Creek as the "best alternative" to Site C on the grounds that it was the only major project that could be built in the same general time period as Site C. Hydro also claimed that Hat Creek could be considered representative of thermal alternatives to the Site C hydroelectric alternative, but they presented no evidence to substantiate that claim.

At the re-opening of the demand phase at the end of the hearings, Hydro indicated that Hat Creek had been dropped from the system plan and could no longer be considered the "best alternative" to Site C. The only rationale left for using Hat Creek in a comparison was its status as a representative thermal alternative.

Hydro did not do a benefit-cost analysis of Site C relative to other projects that might be feasible because of the later in-service requirement it is now forecasting. For example, it did not do one relative to Murphy Creek or to the installation of generating capacity at Keenleyside. Nor did Hydro undertake a benefit-cost analysis of Site C relative to nonstructural alternatives (use of existing sources like Burrard, planning alternatives, purchase of industry generated power, investment in conservation), as prescribed in the provincial guidelines, since it did not consider many of the nonstructural alternatives practical or reliable (31:5,292).

Optimal System Plan - The system plan describes the proposed timing and sequence of new projects. In its engineering economic analysis, Hydro compares the total system costs associated with alternative system plans to determine which project should be constructed next. This is more appropriate than comparing individual project costs, since it is not a project in isolation that one must consider, but rather how different projects fit into and affect the overall system.

But for its social benefit-cost analysis, Hydro did not analyze and compare alternative system plans. Two problems arise from this. First, with regard to the sequence of projects, a project with the lowest unit energy costs will not necessarily be the best project to be constructed next in the system plan; this will depend in part on the size of the projects relative to the growth in requirements. Second, with regard to the timing of the project, the in-service date dictated by Hydro's planning criteria will not necessarily be optimal from a social benefit-cost point of view.

The provincial Guidelines for Benefit-Cost Analysis indicate that a test of alternative in-service dates should be undertaken to determine the optimal timing of a project from the social point of view. Hydro did not do this because it times projects on the basis of its technical planning criteria. Those criteria plus the load forecast dictate specific in-service dates. If the technical planning criteria are relaxed, for example, taking into account non-firm sources of supply, then, according to Hydro's over and under supply analysis, "the [timing] results, using fairly conservative assumptions, are unequivocal when looked at from the point of view of Hydro's customers (i.e. at a 3% discount rate)... it becomes somewhat more in doubt if you take the social cost or provincial point of view" (31:5,360). Hydro recognized that the two perspectives do not necessarily produce the same results. Whether this is the case with respect to timing is still unclear (31:5,360).

Social Cost Estimate - Hydro's social cost estimate for Site C is based on its engineering estimates of facility construction and operating costs and on estimated resource losses. Questions were raised about these estimates, particularly resource losses. Their reliability directly affects the validity of the benefit-cost conclusions. All matters related to the estimated resource losses are discussed in Part Five of this report.

The Commission concludes that Hydro's social benefit-cost analysis suffers some deficiencies. The Commission does not question, as some did at the hearings, the benefits of new supply on a stand-alone basis. Assuming it is timed properly, the Commission is convinced that the social benefits of new electricity supply exceed its present level of social costs.

The Commission is concerned, however, about the best means of providing new supply. The only measure of Site C's social benefits that Hydro provided — the costs avoided by not having to build Hat Creek — is no longer relevant since, by Hydro's own admission, Hat Creek is no longer the best alternative to Site C. Its being a representative thermal alternative is irrelevant as well, for even if Hat Creek were the best thermal option, all that would indicate is that Site C is better than thermal; it would not indicate that it is better than other hydroelectric projects or other power sources.

The Commission concludes that , from a provincial point of view, and with reduced growth rates, the optimal system expansion plan may be different from the one Hydro has proposed in which Site C is the next major project after Revelstoke.

To satisfy the Commission that the proposed Site C project is justified from a social benefit-cost point of view, Hydro would have to demonstrate that a system expansion plan with Site C constructed for an October 1990 in-service date is more economic, taking all social benefits and costs into account, than all other timing and sequences of feasible projects, given a reasonable range of *forecasts of demand. This has not been done. The Commission therefore concludes that, in effect, a comprehensive benefit-cost evaluation of the system plan is required, taking full account of the social and economic costs of the alternative projects, expected revenues from surplus sales, and the consequences and costs of over and under supply.*

3.0 SUMMARY AND OVERALL ASSESSMENT OF SUPPLY AND PROJECT JUSTIFICATION

With respect to timing, the Commission concludes that the government should ensure Hydro does not begin construction prematurely. This suggests to the Commission that construction of Site C should not be authorized any earlier than required for an October 1990 in-service date. Given a realistic construction period of six years, the Commission concludes that construction need not begin before the spring of 1985 and, therefore, an Energy Project Certificate need not be issued prior to the fall of 1984. Any earlier issuance and start-up of construction would, in the Commission's view, reduce Hydro's flexibility in responding to further slippage in load growth or change in system plan.

The Commission further concludes that it has not been demonstrated that Site C is the best possible project from a provincial point of view. Different system expansion plans might be preferable particularly if the in-service date for the next new project is deferred.

CHAPTER IX FINANCIAL IMPACT OF SITE C

1.0 HYDRO'S POSITION

Hydro estimated the capital cost of the Site C project to be $3.2 billion in nominal (i.e. inflated) dollars (Ex 413), which is approximately equivalent to $1.5 billion in constant 1981 dollars (Ex 419).[1] These estimates are based on an October 1989 in-service date. Hydro did not reestimate costs and financial impacts for the 1990 in-service date indicated by its September 1982 load forecast, but it did estimate that each year's delay will increase the capital costs by $290 million in nominal dollars (105:17,144), most of which would be due to inflation as opposed to real cost increases.[2]

Hydro submitted that its record with recent comparable projects demonstrates that it is capable of controlling the costs of Site C. In terms of financial feasibility, Hydro's underwriters indicated that the 10-year financial plan incorporating Site C is achievable:

> I [the underwriter from Salomon Bros.] am satisfied that B.C. Hydro has the ability to acquire the finances to satisfy such a plan (105:17,209).

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[1] The nominal estimate refers to the actual amount of dollars that will be spent over the course of the construction period. The real estimate was calculated by deflating the nominal expenditures by Hydro's estimated rate of inflation between 1981 and the year of expenditure.

[2] Hydro estimated that the near two-year delay from December 1987 to October 1989 would raise Site C capital costs by $40 million in real (constant dollar) terms, due to a $50 million real increase in corporate overhead and $10 million real decrease in interest during construction (107:17,392). Changes in real interest rates will further change these estimates.

Hydro estimated that the Site C cost of service per unit of energy delivered to the grid at Kelly Lake would be 20 mills per kWh on an equivalent uniform basis over the life of the project.[1] The 1992 (first full year of operation) cost of service would be 54 mills per kWh (in constant 1981 dollars) and would decline thereafter, as shown in Table 10 (Ex 413: 1).

The effect of Site C costs on the total Hydro system would be to raise rates initially by 3% in the first year and a maximum of 7% in the second year. Over time, this effect would decline and by the year 1997, Hydro estimated that the existence of Site C would reduce average customer rates (Ex 413A).

This impact on electrical rates is based on a number of assumptions including inflation rates, interest rates and in-service dates. Hydro submitted that the assumptions employed are justifiable and any changes resulting from reasonable variations in these assumptions would not alter the general magnitude of the impact on customers.

2.0 THE ISSUES

The financial aspects of the Site C project raise two main issues: (1) borrowing requirements and the ability of Hydro to finance the project; and (2) the cost of service and rate impacts on Hydro customers.

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[1] In other words, the annual costs of service per kWh for Site C over the assumed 70-year life of the project would be equivalent to a constant real charge of 20 mills per kWh at a 3% real discount rate.

TABLE 10

B.C. HYDRO ESTIMATED COST OF SERVICE FOR SITE C ELECTRICAL ENERGY DELIVERED TO KELLY LAKE

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Cost of Service ($ millions) (Schedule 1.2)[1]	$ 172.5	$ 517.1	$ 568.1	$ 554.3	$ 538.9	$ 524.8	$ 511.9	$ 500.4	$ 490.1	$ 481.1
Energy Delivered (GWh)	1,247.0	4,171.0	4,390.0	4,390.0	4,390.0	4,390.0	4,390.0	4,390.0	4,390.0	4,390.0
Cost of Service Per Unit of Energy (mills per kWh)	138.3	124.[illegible]	129.4	126.3	122.8	119.5	116.6	114.0	111.6	109.6
Cost of Service per Unit of Energy (Constant (1981) Dollar mills per kWh)	67.8	56.0	53.9	48.5	43.4	39.0	35.1	31.6	28.5	25.8
Equivalent Uniform Non-Inflated Unit Cost (Constant (1981) Dollar mills per kWh)	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9

[1] First 10 years of operation - amounts are in inflated dollars.
Cost of service refers to the cost of power from Peace Site C delivered to the Kelly Lake Substation but does not include existing transmission facilities cost nor distribution system costs and losses.

2.1 Borrowing Requirements and Financing

Hydro does not finance specific projects; its borrowing requirements and financing are based on the capital expenditure for its entire system plan. Hydro's latest financial plan[1] calls for total capital expenditures of $17.3 billion in nominal (i.e. inflated) dollars over the 1982 to 1992 period, of which $13.7 billion will have to be financed by debt. The Site C project will constitute approximately 18% of the total capital expenditures (Ex 412). Hydro's underwriters indicated that this financing requirement could be met. The underwriters agreed that they were not committed to lending or underwriting the sums Hydro projected it will require. Rather, they were simply indicating that "under the current set of conditions and the plan as it exists now ... those resulting borrowing requirements would be feasible" (105:17,210).

An important factor, which could affect the feasibility and cost of Hydro's borrowing, is the maintenance of Hydro's triple A credit rating. It was estimated that, given the market conditions prevailing at the time of the hearings, a downgrading to double A would result in interest rates increasing in the order of 1/4% to 3/8%. A further slide in the rating or even the anticipation of such a prospect could result in a larger increase (105:17,194). More significantly, the availability of funds would decline (105:17,185).

A critical factor underlying Hydro's current triple A rating, and perhaps the single most important factor contributing to the feasibility of its financing, is the 100% guarantee of Hydro's debt by the provincial government. The 1.3 interest coverage ratio[2] that Hydro currently attempts to achieve would be inadequate if the government guarantee did not exist.

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[1] Based on Hydro's May 1982 Interim Forecast. This plan excludes the Hat Creek project.

[2] The interest coverage ratio refers to the amount by which net revenues exceed interest costs. A 1.3 interest coverage ratio means that net revenues (after all costs except for interest cost have been deducted) exceeds interest costs by a factor of 1.3.

> A triple A U.S. utility has coverage in excess of four times. 1.3 without other support is extremely low and probably wouldn't even be a single A [rating] (105:17247).

Hydro's financial performance also affects its ability to obtain the financing it requires. A prolonged inability to realize its financial targets due to market conditions, operating inefficiencies or legislative and regulatory constraints would raise concerns by lenders. "The regulatory climate is a very critical one for utilities and receives a very heavy focus by investors" (105:17212).

The financial panel agreed that, in view of the province's 100% guarantee of Hydro's debt, lenders will regard the province to be as much the borrower of these funds as Hydro (105:17,207). This not only means that Hydro's ability to obtain funding will be influenced by the financial performance of the province, but also that the terms and availability of credit for other potential, government-related borrowing will be affected by Hydro's financial situation and performance.

> A lender has, I believe, certain limits as to how much credit exposure we get in any one name and if B.C. Hydro had to in effect compete with other B.C. names for that limited supply of lender dollars that could be a crowding effect there (105:17,215-216).

The Commission concludes from the evidence submitted at the hearing that the financial plan for Site C is feasible. Barring any change in the perceived credit worthiness of Hydro or the province, the funds Hydro requires should be available. However, given Hydro's current financial targets, this financing depends on the government's 100% guarantee. The Commision further concludes that because of the 100% guarantee, borrowing by Hydro affects the borrowing capacity for the province as a whole.

2.2 Cost of Service and Rate Impact of Site C

Because Hydro's corporate and financial planning are based on the entire system, the financial impact of one particular project is difficult to isolate. Hydro determined the rate impact of Site C by comparing the per unit costs of service for the entire system with Site C to the costs without Site C. No project was substituted for Site C in the 'without' case, although future projects were still assumed to come on stream; instead, per unit costs were calculated by reducing the system sales by the average energy output of Site C (delivered to Kelly Lake). Hydro used this calculation in its estimate that the initial impact of Site C would be to raise rates by 3% in the first year and a maximum of 7% in the second year. Hydro's last filing on rate impacts gave an increase of 5% in 1992 (the first full year of operation) (Ex 441).

One problem with this approach is that the impact of Site C on rates is obscured by the impacts of the projects that follow it in the system plan (107:17,455). A different method of isolating the financial impact of Site C is to compare the per unit costs of service of the system frozen at the post-Revelstoke level of output with the per unit costs of service of the system frozen at post-Site C level of output. Using this method and incorporating line losses and estimated distribution costs in order to capture the full impact on the customer, Hydro calculated that Site C would result in rate increases of just under 8% instead of the 5% given by the first method (Ex 441).

Regardless of methodology, the evidence shows clearly that Site C will initially cause some increase in customer rates. Three important factors affecting the extent of this increase will be the actual capital cost of the project, the real interest rate and the realization of forecast demand.

With respect to capital costs, Hydro's historical record shows that actual completed costs (in real terms) have ranged from as low as -8.3% to as high as +13.1% of preconstruction estimates (Ex 418). Comparable variation in Site C actual costs could cause the rate impact to be nearly half or double the initial 5% suggested by the projected costs estimate (Ex 441).

It is not just the total capital cost that would affect the rate, but also the real interest cost of that capital. Hydro agreed that increases in the real interest rate would significantly increase the rate impact of Site C (107:17476). It should be noted that if inflation rates fall during the term of the loan real interest rates will increase to the extent that borrowed capital is locked in at fixed nominal rates. This is a basis for concern and is one reason why Hydro is moving toward shorter maturities (107:17,478-9).

With respect to forecast demand, Hydro agreed that if Site C were underutilized, its impact on rates would increase. At 50% underutilization, and Hydro's projected capital cost of $3.2 billion, the initial effect of Site C would be to increase rates by 12%. At 100% underutilization its effect would be to raise rates by 14.6% (Ex 441). The problem here is comparable to that currently anticipated for Revelstoke. If a plant is constructed, but the forecast load does not materialize, the costs of the new plant must be recovered from a smaller volume of sales. Because of the fixed cost nature of hydroelectric facilities, this impact can be quite pronounced.

The Commission, is not completely satisfied that the evidence submitted by Hydro indicates clearly the full incremental rate impact of Site C on Hydro customers. THE COMMISSION RECOMMENDS THAT IN FUTURE APPLICATIONS HYDRO PROVIDE DATA ON THE RATE IMPACT OF THE PROPOSED PROJECT, ISOLATED FROM THE IMPACTS OF THE PROJECTS WHICH MAY FOLLOW AND FULLY INCORPORATING ALL LINE LOSS AND DISTRIBUTION COSTS TO SHOW THE IMPACT ON CUSTOMERS. HYDRO, WHEN COMPARING PROJECTS, SHOULD ALSO PROVIDE DATA ON THE DIFFERENT PATTERNS OF RATE IMPACTS ASSOCIATED WITH THE VARIOUS ALTERNATIVES.

Notwithstanding the foregoing, the Commission believes that Site C is likely to have a moderate initial impact on customer rates. Only if capital costs or real interest rates are significantly higher than current projections or if the load forecast does not materialize (i.e. if the project is constructed prematurely) will the rate impacts be very pronounced.

CHAPTER X PROJECT JUSTIFICATION: CONCLUSIONS AND RECOMMENDATIONS

1.0 SUMMARY OF POSITION TAKEN BY HYDRO AND INTERVENORS

In its original application, Hydro took the position that:

> "A new source of [electrical] energy will be required in 1986 or as soon as possible thereafter ... Other potential projects are not sufficiently advanced that they would become feasible alternatives to the Peace Site C project for a 1987 in-service date; ... provided appropriate mitigation and compensation measures are implemented the real project impacts can be kept to a minimum and the project can be made environmentally and socially acceptable to the people of British Columbia ... [and finally] ... a benefit-cost analysis carried out in accordance with the Guidelines for Benefit-Cost Analysis ... [serves to demonstrate] that even when all social impacts are taken into account ... the project still makes economic sense. The allocation of resources is economically efficient" (Ex 15:C-4-7).

During the course of the hearings, Hydro submitted updated demand load forecasts, the latest of which was dated September 1982. On this most recent basis, it concluded that a new source of electric energy will not be needed until October 1990. In all other respects, however, Hydro's position on project justification remained the same. As summarized in final argument, Hydro maintained -

1. a new source of future power will be required by 1990;
2. Site C is the best project available to meet this need;
3. from a technical point of view, the project is feasible and the design is well conceived and thoroughly investigated;
4. from a financial point of view, the projected costs are reasonable, within the capabilities of Hydro to finance and will result in only a 6% increase in rates; and

5. from a provincial perspective the environmental and socio-economic impacts would not be very great and the proposed mitigation and compensation measures will offset impacts which would otherwise result in regional inequities, making the project acceptable to the Province as a whole (112:18,204-6).

In response to those who questioned whether it had proven the need, Hydro maintained that while demand can never be "proven" until it is manifest, its 1990 date is a reasonable planning target. Regarding the question of net benefits, Hydro maintained that its benefit-cost analysis was appropriate as one input into the justification issue and was generally consistent with the provincial guidelines.

Of the intervenors who addressed the broad issue of project justification, some supported Hydro's position, others argued against it.

The Electrical and Electronic Manufacturers Association of Canada and the Mining Association of British Columbia submitted that the project was justified because of the economic growth potential in the Province. The Mining Association specifically referred to the need to allow for the expanding needs of the provincial mining and smelting industry. The B.C. Chamber of Commerce voiced its support for B.C. Hydro's application on the condition that the load forecast is correct. Mr. Nigel Hannaford of Ft. St. John argued that that project is justified because it is environmentally and economically the best supply option.

Those who argued that the project was not justified focussed on the questions of timing, benefits and alternatives.

The Society Promoting Environmental Conservation (SPEC), in its final argument, concluded that Hydro did not prove that the energy is required or that Site C is the best alternative, nor did it even attempt to "prove that the benefits from Site C outweigh its costs and that it is therefore in the Public Interest" (114:18,570).

The Peace Valley Environmental Association (PVEA), in its final argument likewise concluded -

> Even if the Commission were to conclude that there was a demand for 900 MW of electrical energy in British Columbia by 1990, which, as [SPEC] has demonstrated cannot be concluded - B.C. Hydro has not provided the Commission with the evidence required under Regulation 388/80 and S.51 of the Act to show that:
>
> 1. Site C provides any benefit;
> 2. Site C provides more benefit than any of the structural or non-structural alternatives;
> 3. Maximum benefits would be obtained by commencing operation of Site C in 1990 (114:18,651-2).

Both SPEC and PVEA maintained that under the terms of reference and its obligations under the Utilities Commission Act, the Commission cannot conclude or recommend to the government that the project is justified.

Mr. Leo Rutledge and Mr. Randal Hadland, both residents of the Peace Valley, also argued that the project is not justified. Mr. Rutledge maintained that Hydro has seriously underestimated the social values that would be lost as a result of the flooding of the valley. He concluded that "whether to dam or not to dam must, in the final analysis, rest with value judgment, made by those competent to judge values" (115:18,820). Mr. Hadland stated that in his view Hydro has not justified the project and the Site C Commission has only two choices with respect to the application:

> ...one, to deny the application on the grounds that Hydro has not proven its case; or two, to delay a judgment until better information is available, which amounts to a denial of the application (116:18,833).

Mr. Hadland also recommended the encouragement of small-scale alternatives.

During the Vancouver phase, several intervenors, including representatives from the New Democratic Party, and Messrs. Chessor, Charlton and Bartz argued that Hydro's rates should be restructured to encourage conservation and other alternatives to Site C should be explored. Others at the Vancouver phase, including Mr. Deverall and Ms. Nitins and Messrs. Powell and Emerson, argued the project is not justified because of its agricultural land impacts. Mr. Maxey argued that Site C must be seen in a bigger development scheme, including flooding of Site E and the McGregor Diversion. Some intervenors, for example, Mr. Black and the Communist Party of Canada argued that Hydro should consider repatriating power under the Columbia River Treaty. Finally, some intervenors, such as Messrs. Wichlinski, McAllister, and Butterworth, simply argued against general adverse effects of development.

2.0 THE COMMISSION'S POSITION ON PROJECT JUSTIFICATION

The proposed Site C project has been subjected to an unprecedentedly thorough examination. The Commission has carefully weighed the evidence and arguments put forward by the Applicant and the Intervenors and has arrived at the following position:

The Commission accepts Hydro's contention that, if its customers demand more electricity than its system can produce, creation of a new source of supply is in the provincial interest. Moreover, on the basis of its detailed review of design, financial and environmental and social impacts as presented in this report, the Commission has not found any overriding impediment which would dictate the abandonment of the Site C project, since many of the adverse impacts can be significantly reduced through mitigative measures or, in the case of resource losses, financial compensation can be made.

On the basis of the evidence, however, the Commission is not satisfied that Hydro has demonstrated that a 1983 construction start-up date is justified or that Site C is the only possible source of supply to follow Revelstoke in the system plan, or that it is preferable to all other sources.

Hydro has not shown that Site C is preferable to the Murphy-Keenlyside complex, planning agreements through the Alberta intertie, the East Kootenay thermal project or the Stikine-Iskut complex, or that any of these alternatives or a combination of them cannot be completed in time to meet forecast load requirements. The Commission concludes that a full comparison of the alternative system plans feasible in light of the forecast load requirements must be done in order to determine whether Site C is the best project to follow Revelstoke. The Commission emphasizes that alternative system plans, not individual projects must be compared. Moreover, the comparisons must be made in a manner consistent with the evaluation criteria government has established to ensure that new energy projects are in the provincial interest.

THE COMMISSION THEREFORE RECOMMENDS THAT CABINET DEFER ISSUING AN ENERGY PROJECT CERTIFICATE FOR THE PROPOSED SITE C PROJECT UNTIL THE FOLLOWING TWO CONDITIONS ARE SATISFIED:

1. *THAT AN ACCEPTABLE LOAD FORECAST DEMONSTRATES THAT CONSTRUCTION OF SITE C MUST BEGIN IMMEDIATELY IN ORDER TO AVOID SUPPLY DEFICIENCIES; AND*

2. *THAT A COMPARISON OF THE TOTAL ENGINEERING, CONSTRUCTION, ENVIRONMENTAL AND OTHER SOCIAL COSTS OF THE ALTERNATIVE SYSTEM EXPANSION PLANS WHICH CAN MEET THE FORECAST REQUIREMENTS DEMONSTRATES THAT SITE C IS THE BEST PROJECT TO MEET THE ANTICIPATED SUPPLY DEFICIENCY.*

The Commission has concluded that construction of a new project need not begin any earlier than the spring of 1985. THE COMMISSION RECOMMENDS THAT IN THE FALL OF 1984 CABINET DETERMINE IF THE ABOVE TWO CONDITIONS ARE MET. IN KEEPING WITH PROVINCIAL ENERGY POLICY, THE COMMISSION RECOMMENDS THAT CABINET DIRECT THE B.C. UTILITIES COMMISSION TO HOLD PUBLIC HEARINGS, STRICTLY

LIMITED TO THE ISSUES OF LOAD GROWTH AND ALTERNATIVE SYSTEM PLANS, TO ASSIST IT IN MAKING THESE DETERMINATIONS. IF, AT THAT TIME, THE ABOVE TWO CONDITIONS ARE MET, THE COMMISSION RECOMMENDS THAT THE CABINET ISSUE AN ENERGY PROJECT CERTIFICATE, SUBJECT TO THE CONDITIONS RECOMMENDED IN PART V OF THIS REPORT. IF THE ABOVE TWO CONDITIONS ARE NOT MET, THE APPLICATION FOR A CERTIFICATE SHOULD BE FURTHER DEFERRED OR REJECTED, AS APPROPRIATE IN LIGHT OF THE INFORMATION AVAILABLE AT THAT TIME.

The Commission wishes to stress that, if future load forecasts show further slippage in the need for Site C energy, the issuance of an Energy Project Certificate and the earliest allowable commencement date for construction should reflect the later in-service requirements.

The Commission recognizes that during the period when a decision on Site C is being deferred, Hydro might apply for an Energy Project Certificate for a different project. THE COMMISSION RECOMMENDS THAT IF THIS DOES TAKE PLACE, ANY REVIEW OF THE APPLICATION BE CONFINED TO PROJECT-SPECIFIC ENGINEERING AND DESIGN, AND ENVIRONMENTAL AND SOCIAL IMPACT ISSUES. THE MATTER OF PROJECT JUSTIFICATION SHOULD BE DEALT WITH AT THE SAME TIME AS THE REVIEW OF THE SYSTEM PLAN IN RELATION TO SITE C.

If the Cabinet decides to direct the B.C. Utilities Commission to hold public hearings for the review of load growth and alternatives, the Commission believes that the terms of reference should be clearly restricted to ensure an efficient and speedy examination of material. A long and exhaustive hearing is not required. The purpose of the review would simply be to determine whether construction on a new project should begin immediately in order to meet future requirements, and whether or not Site C is the most appropriate alternative to meet the requirements from the provincial point of view.

PART FOUR PROJECT DESIGN

CHAPTER XI - ADEQUACY OF DESIGN AND PUBLIC SAFETY

1.0 INTRODUCTION

The terms of reference for the review of Site C directed the Commission to:

> ... review the adequacy and technical feasibility of the project, public works and ancillary undertakings including consideration of design, safety and timetable in the construction and operation phases.

The Commission appointed the consulting engineering firm of Surveyor, Nenninger, and Chenevert Inc. (SNC) to carry out a complete review of the design Hydro presented with its application. (The design is found in Ex 130-145.) This review was covered in a report filed as Ex 154 and was available to all the intervenors.

Design adequacy and public safety were covered in Phase III of the hearings and are dealt with in this Chapter.

2.0 HYDRO'S POSITION

Hydro testified that only sound standard engineering techniques were employed in preparing of the Site C project design. It also pointed out that, while engineering is commonly regarded as a relatively exact science, every aspect of the design requires expert knowledge and experienced judgement; Hydro considers its staff and consultants to have the required knowledge and judgement.

To avoid human error insofar as is possible, Hydro maintains an internal and external system of checking throughout all phases of a project, from design to the post-construction stage (43:6,901-5; 46:7,328-44: Ex 213). The external system of checking is provided by an independent Advisory Board of recognized outside experts.

Hydro's Chief Engineer explained the precautions taken to ensure an adequate design and public safety (43:6,901-5; 46:7,328-44) He assured the Commission that he had no reservations regarding the adequacy of the design.

3.0 THE ISSUES

Intervenors raised the following issues regarding safety and design:

- stability of the reservoir banks and reservoir management;
- powerhouse, dam and spillway design;
- seismic activity;
- downstream effects;
- location of transmission lines.

Concerns were also expressed about the proposed construction schedule and management, and the operation of the completed project.

3.1 Reservoir Bank Stability and Reservoir Management

Reservoir bank stability was raised as a major concern by a number of intervenors. Hydro and its consultants were cross-examined extensively by intervenors and Commission counsel on the types of bank stability problems: the cause, location, timing, and extent of future slides, and the implications of seismic activity.

Hydro testified that it used a conservative approach in selecting a safeline around the reservoir within which no dwellings or commercial or public buildings would be allowed (34 : 5,849). A program was proposed to monitor all indications of incipient slides, sloughing and subsidence. Treatment for low banks, where sloughing can occur, will be different from that for high banks where major slides are a long-term threat. Hydro indicated that sloughing would increase in the low bank areas as a result of reservoir filling but that within five years stabilization would occur due to beaching (34 : 5,851). Hydro testified that major high bank slides would not be affected by reservoir filling.

Sites with major slide potential are situated just east of the 1973 Attachie slide, at Tea Creek, and on the Moberly River. Damage will occur in the area immediately surrounding a major slide as a result of physical impact and large waves (Ex 131 : Sec. 4.4; Ex 138-9).

A further major source of concern was the danger of over-topping the dam by slide-induced waves. Hydro testified that the Attachie area is much too far away for slides there to affect the dam, and that further simulations on a hydraulic model of the possible effects from Tea Creek and Moberly River slides have demonstrated conclusively that the size and velocity of movements at those locations cannot imperil the dam (42 : 6,799-802; Ex 138; Ex 139).

The potential for changes in the groundwater regime to reactivate slides was also raised as an issue. Hydro's studies indicated that any changes in the groundwater would not have this effect.

Hydro did indicate that the overburden in the eastern part of Hudson's Hope, designated as Zone A in Hydro documents, was of particular concern (see Figure 5). It testified that this problem will be specially treated by construction of a berm prior to flooding in order to provide a stable shoreline and control sloughing. This solution will render unnecessary the relocation of any residences in the area.

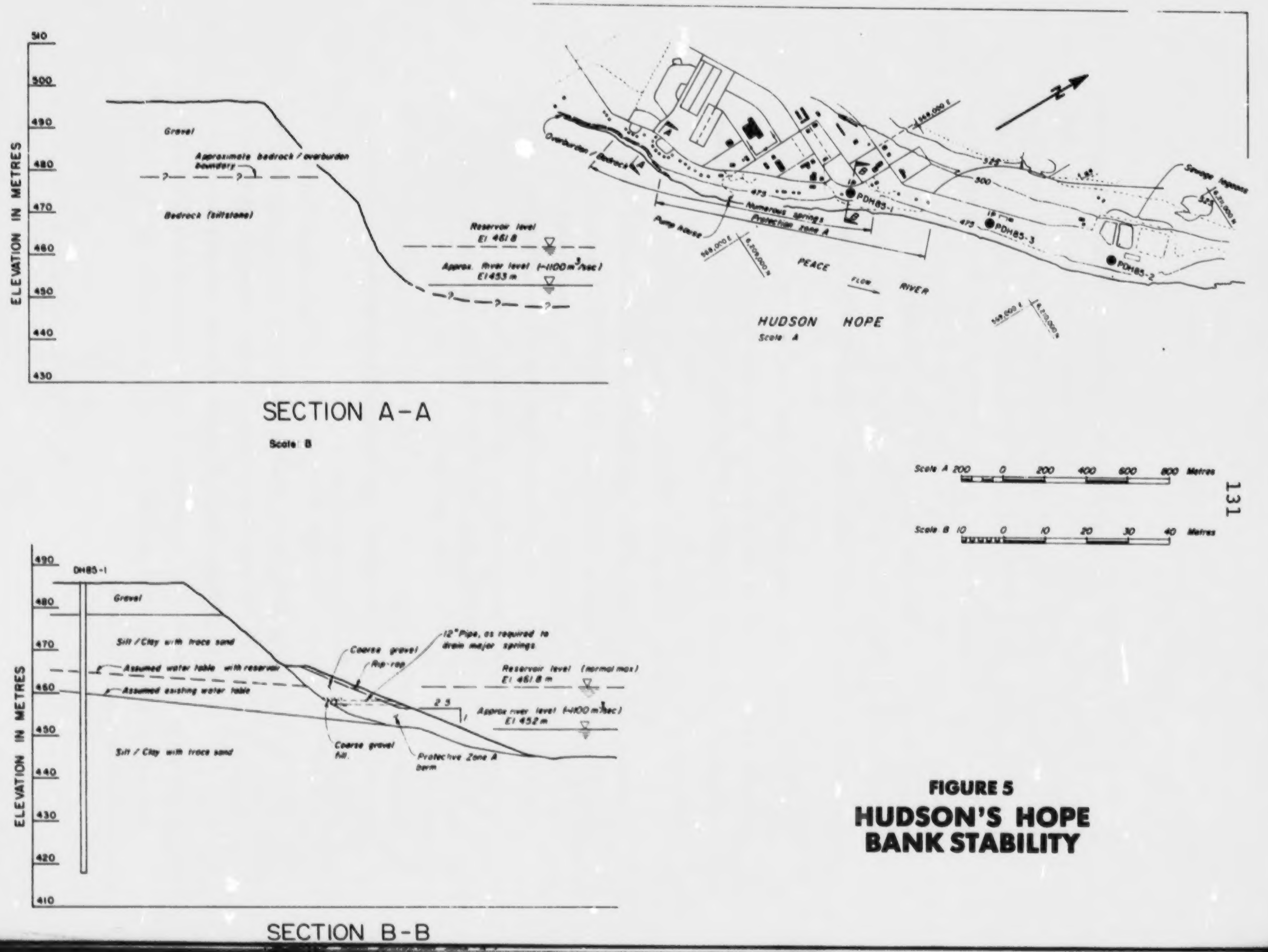

FIGURE 5
HUDSON'S HOPE
BANK STABILITY

Hydro was questioned regarding possible downstream effects from any leakage (following reservoir filling) past the dam through the right bank via basal gravels in old river bed(s) within the preglacial or interglacial valley. Hydro indicated that because of the nearly flat gradient (low head of water and long path) it was likely that any leakage flow, if it did in fact occur, would be so low that the chance of any significant movement of material would be non-existent.

Finally, Hydro testified that siltation of the Site C reservoir would not be significant as far as the main stem of the Peace River is concerned because the Williston impoundment forms a very effective long-term trap for sediment which will pass virtually no material. Furthermore, sedimentation from the Moberly and Halfway Rivers and other streams is relatively small and will not affect the reservoir's operation significantly for several hundred years (40: 6,527-43).

The Commission acknowledges the very real concerns of the intervenors with respect to reservoir bank stability and operating conditions in the reservoir. The Commission concludes, however, that the monitoring to be conducted by the Comptroller of Water Rights pursuant to the proposed Water License, together with Hydro's plans for further and ongoing studies during construction and early operation, will protect the public.

In view of Hydro's assessment of likely significant effects from leakage through the old river bed being essentially non-existent, and also recognizing Hydro's intentions regarding monitoring (and presumably to take any necessary remedial measures), the Commission is satisfied that a reasonable approach to the matter has been taken and that public safety will be adequately protected.

WITH RESPECT TO RESERVOIR BANK STABILITY AND RESERVOIR MANAGEMENT THE COMMISSION RECOMMENDS THAT HYDRO, AS CONDITIONS OF A WATER LICENCE, BE DIRECTED TO:

1. *MAKE INSPECTIONS AS FREQUENTLY AS APPROPRIATE, BUT AT LEAST ONCE A YEAR, OF THE KNOWN POTENTIAL SLIDE AREAS AROUND THE RESERVOIR TO PROVIDE WARNING OF IMPENDING SLIDES;*
2. *MAKE AN ANNUAL GENERAL INSPECTION OF THE RESERVOIR PERIMETER TO IDENTIFY NEW SLIDE AREAS;*
3. *REPORT ON THE ANNUAL INSPECTION TO THE WATER COMPTROLLER IN SUCH A MANNER AS TO GIVE WARNING OF ANY POTENTIAL SLIDES—THIS WILL HAVE THE ADDED ADVANTAGE OF ESTABLISHING A WELL-DEFINED SET OF PRE-CONSTRUCTION CONDITIONS;*
4. *MAINTAIN, DURING THE PERIOD OF FLOODING, AN INTENSIVE MONITORING PROGRAM AROUND THE PERIMETER OF THE RESERVOIR,INCLUDING THE BANKS AT HUDSON'S HOPE;*
5. *MONITOR, THEREAFTER, THE STABILITY OF THE BANKS IN SUCH A MANNER AS TO PROTECT THE PUBLIC.*

THE COMMISSION FURTHER RECOMMENDS THAT HYDRO BE DIRECTED TO DIFFERENTIATE BETWEEN TRULY DANGEROUS AREAS AND THOSE AREAS THAT CAN BE USED WITH SAFETY, BY THE POSTING OF SPECIFIC WARNINGS OR PROHIBITIONS OF USE ALONG THE SHORELINE. Chapter XIX contains further comments on this subject.

3.2 Powerhouse, Dam and Spillway Design

Hydro provided extensive evidence on the foundation design for Site C which it indicated will require great care. Hydro testified that problems of weakening and softening of bedrock would be solved by sealing the bedrock faces in foundation areas as soon as they are exposed (34:5793). The Water Comptroller's consultants expressed concern about the effects of rebound[1] in the deeper excavations, and the need for flexibility in the penstock encasement between the powerhouse and the anchor block above. Hydro had parallel concerns and described its proposals to cope with the problem.

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[1] Prior to excavation, the material is under compression; after excavation, the compressive forces are released, the material expands, and fissuring and fracturing can occur. This is referred to as a rebound.

The Commission's consultants pointed out the critical nature of the spillway and stilling basin design. Hydro indicated that it intended to do extensive model testing before finalizing the design (36:6,090-1).

Hydro testified that dam failure would be highly unlikely but that, if it should occur, it would be gradual because of the nature of the design and materials. This would allow warning downstream to avert loss of life, although some property damage would be inevitable.

The Commission concludes that Hydro is aware of, and fully competent to deal with, the conditions that must be met to achieve an adequate design for the dam and spillway for the Site C project, and that Hydro will take the steps necessary to do so.

The Commission further concurs with Hydro's system of internal checks, and in particular, with the appointment of an independent external Advisory Board to review the design, construction and post-construction phases of the project.

3.3 Earthquakes

The possibility of earthquakes or other seismic activity, which might affect the Site C project was raised and the consequences examined. The possibility of seismic action arising from filling the reservoir was included.

Hydro presented evidence indicating that earthquakes are rare in the Great Plains region. The largest recorded earthquake near Site C was 115 km away in the Rocky Mountains and had a magnitude of 3.7 on the Richter Scale (34:5,820). Hydro pointed out that filling the much larger Lake Williston did not induce seismicity and that none is expected from Site C. Hydro testified that no record exists anywhere in the world of an earthquake retriggering a previous slide and that an earthquake-induced liquefaction slide is impossible in the overburden soils at Site C because the material has been over-consolidated by natural geologic processes (42:6,829-33).

The Commission concludes, on the evidence presented, that significant earthquake or other seismic activity is very unlikely and is being handled adequately in Hydro's design considerations for Site C.

3.4 Downstream Effects

Several intervenors expressed concerns about the effect of changing water flows and water quality changes, particularly temperature. Hydro testified that because Site C is a run-of-the-river plant with no significant storage, the same minimum water releases as are presently required will be maintained (37:6,173).

With respect to downstream effects, insofar as adequacy of design and public safety are concerned, the Commission concludes that no new problems arise from Site C. The Commission considers water flow and quality changes to be operational impacts rather than matters of design and they are dealt with in Chapters XIV and XV.

The Commission's recommendations regarding conditions for a Water Licence are described in Chapter XIX and detailed in Appendix 9. These recommendations re-establish the operating limits as measured at the Taylor gauge and make provision for negotiating improvements in fluctuations of flows.

3.5 Transmission

Intervenors expressed concerns about the location of the 500 kV transmission lines connecting Site C to the integrated system at Peace Canyon generating station, and about the additional 500 kV line connecting the Williston substation to Kelly Lake. Hydro testified that the line from Site C to Peace Canyon would replace the existing 138 kV line and will require little extra clearing. The line from Williston to Kelly Lake, required to reinforce the Peace River transmission system, would run parallel to the existing lines, and would, therefore, cause minimum environmental impact. Hydro testified that the new lines would improve system stability and reliability as well as reduce transmission system losses (Ex 134 : 2).

The Commission concludes that the additional transmission lines are essential to the project. The Commission has commented in Chapter XIV on the lack of information respecting the impacts of their construction and has made specific recommendations concerning rectifying these deficiencies. The Commission concludes that, if the measures suggested in Chapter XIV are undertaken, the adverse impact of the transmission lines can be minimized and, where unavoidable, compensated for.

3.6 Project Schedule, Project Management and Cost Estimate

Hydro indicated that the Site C project could be built in six years, including time for tendering (Ex 15, Fig. B-II-1). However, in the re-opened Demand Phase, in November 1982, Hydro stated that it would prefer to start construction in 1983 to meet an in-service date of 1990. The Applicant agreed, however, that with some qualification as to cost, a 1984 start would be adequate. Hydro's original application envisaged commencement of construction in 1982, with an in-service date of October 1987, using six construction seasons.

The Commission attaches great importance to the construction commencement date because of the uncertainties of load forecasting and the effect of these on the timing of the project (see Chapter X). The Commission concludes that, for an in-service date of October 1990, an Energy Project Certificate should not be issued before the fall of 1984, and then only if a 1990 in-service date is supported at that time by an acceptable load forecast and comparison with alternative system plans. This would permit construction to start in 1985.

Hydro gave evidence that it is in the process of modifying its project management system. The Commission's consultant remarked on the importance of having experience in such matters and suggested that Hydro obtain outside advice before implementing a reorganization (Ex 154 : 53).

The Commission concludes that Hydro is thoroughly experienced in managing the design and construction of hydroelectric projects and will be able to carry Site C forward to a timely conclusion.

Evidence regarding capital cost estimates was brief. The most current estimate filed with the Commission is set out in Table II.

TABLE II

Peace Site C Project Generating Facilities
Estimate of Construction Costs
($ millions)

	At October 1980 Price Levels as Filed on July 20, 1981	October 1981 Price Levels
Direct Construction Costs		
1. Land and Rights	13.4	14.3
2. Flowage[1]	46.9	52.5
3. Site Access	19.5	21.8
4. Site Clearing	1.8	2.0
5. Cofferdams	18.2	20.4
6. Left Bank Stabilization	45.9	51.4
7. Diversion Tunnels	56.0	62.7
8. Low Level Outlet	7.1	8.0
9. Earthfill Dam	73.5	82.3
10. Forebay Channel and Gravity Walls	45.9	51.4
11. Spillway	90.4	101.2
12. Power Intakes and Penstocks	73.8	82.8
13. Powerhouse and Switchgear Building		
- Civil	90.4	101.2
- Mechanical	69.7	78.1
- Electrical	96.9	108.5
14. Construction Services	26.2	29.4
TOTAL DIRECT CONSTRUCTION COST	775.6	868.0
Indirect Construction Costs		
15. Contingencies[2]	90.9	101.8
16. Engineering, Investigations and Supervision[3]	77.7	85.0
17. Hearing Expenses	0.7	0.8
18. Construction Insurance and Bonds[4]	8.5	9.5
TOTAL INDIRECT CONSTRUCTION COST	177.8	197.1
TOTAL CONSTRUCTION COST[5]	953.4	1065.1

Notes to Table

1. Includes costs of reservoir clearing and the relocation of Highway 29 and existing utilities located within the reservoir.

2. Contingencies:

   7.5 percent of all equipment costs.
   10 percent of other direct construction costs.

   Allowance included for environmental and other social mitigation and compensation costs associated with the project.

3. Engineering includes expenditures to date.

4. Construction Insurance and Bonds:

   1 percent of Total Direct Construction Cost plus Engineering Contingencies.

5. Excluding Inflation, Interest during Construction and Corporate Overheads.

The Commission's consultants indicated that they had some concerns respecting the cost estimation procedures employed by Hydro. They did, however, indicate substantial agreement with the total construction cost figure within a 10% margin of error (Ex 154:Sec.8.4).

The Commission notes that, in the past, actual dam construction costs have differed from the engineering estimates. The Commission concludes that, although the compensation/mitigation allowance in the cost estimate is inadequate, the error is not large enough to significantly affect the economics of the project.

THE COMMISSION NEVERTHELESS RECOMMENDS THAT, BEFORE CABINET DETERMINES WHETHER HYDRO HAS MET THE PROJECT JUSTIFICATION PRECONDITIONS IDENTIFIED IN CHAPTER X, HYDRO SHOULD BE REQUIRED TO SUBMIT A COST ESTIMATE DEVELOPED BY FOLLOWING PRESENT DAY BUDGET ESTIMATE PRACTICE AND DETAILED ENOUGH TO IDENTIFY COST ITEMS MORE PRECISELY THAN THE EVIDENCE FILED IN THE HEARINGS.

4.0 ASSESSMENT OF THE ADEQUACY OF DESIGN AND PROTECTION OF PUBLIC SAFETY

The Commission concludes that Hydro's design for Site C is sound and reflects concern for public safety. It further concludes that the capital cost estimating procedure is basically sound for this stage of development.

With respect to the schedule, the Commission concludes that the project can be constructed over a six year period.

THE COMMISSION RECOMMENDS THAT THE COMPTROLLER OF WATER RIGHTS BE DIRECTED TO ISSUE A WATER LICENCE (AS SHOWN IN APPENDIX 9) AND TO MONITOR THE DESIGN, CONSTRUCTION AND OPERATION OF SITE C TO ENSURE THE RESERVOIR IS OPERATED IN THE BEST POSSIBLE MANNER.

PART FIVE IMPACTS

CHAPTER XII INTRODUCTION TO PROJECT IMPACT ASSESSMENT

1.0 TERMS OF REFERENCE

With respect to environmental, land use, social and economic impacts, the terms of reference directed the Commission

> ...to review the nature and extent of potential impacts by the project on the physical, biological, social and economic environments, and consider proposals to mitigate negative impacts and maximize benefits from positive impacts, and proposals to compensate for, or offset, unavoidable negative impacts.
>
> Particular consideration shall be given to short and long-term impacts, related mitigation and compensation proposals, and means for their implementation, regarding:
>
> (a) local climate, including changes in humidity and air quality;
>
> (b) hydrology, including water quantity and quality, effects on downstream users and rights of prior licensees under the Water Act;
>
> (c) terrain resources, including mineral, hydrocarbon and aggregate resources, and land stability;
>
> (d) agriculture, including existing and potential agricultural land and industry;
>
> (e) outdoor recreation, including existing and potential recreational opportunities and scenic amenities;
>
> (f) forestry, including existing and potential merchantable timber, and reservoir preparation and debris control;
>
> (g) wildlife, including existing and potential habitats and populations, and hunting, viewing, trapping and guiding activities;
>
> (h) fisheries, including existing and potential habitats and populations, and fishing activities;
>
> (i) heritage sites, including known resources and areas of heritage potential;

(j) present and future land alienation, including displacement of residents, land owners and resource users, and access alterations;

(k) regional and provincial labour markets, including magnitude, composition, timing, origin and training of the project's manpower requirements, and matters related to the work environment;

(l) community and regional settlement and land use, including housing and building markets, rural land use, and local government corporate status;

(m) community and regional social services;

(n) community social structure, functioning and stability; and

(o) regional and local economies.

These impact issues can be grouped into two classes:

1. The impacts the project will have on the Peace River Valley bio-physical environment and, consequently, on the future exploitation of, and benefits derivable from, the natural resources in the area.

2. The social and economic impacts the project will have on the local communities -- urban, rural and native -- as a direct result of the project's construction and operation and as an indirect result of its natural resource impacts.

Evidence on these impacts and on the measures that can and should be taken to mitigate or compensate for them was submitted and examined in Phase IV of the formal hearings and in the general Vancouver sessions. In addition, a considerable amount of information on these matters was presented in the community hearings held in the region and in special hearings held on Indian reserves located near the project.

2.0 ORGANIZATION OF ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACT REVIEW

This part of the report presents the evidence and the Commission's conclusions and recommendations regarding the project's impacts. Chapter XIII presents key principles governing general resource valuation, mitigation and compensation. These principles had to be clarified before the Commission could analyse the project's specific impacts. Chapter XIV contains the review of the land use and environmental impacts. Chapter XV contains the review of the regional economic and social impacts. Chapter XVI develops in detail proposals for a monitoring program. Finally, Chapter XVII contains a summary of the Commission's conclusions on all these matters.

CHAPTER XIII PRINCIPLES FOR RESOURCE VALUATION, MITIGATION AND COMPENSATION

Formal resource valuation and guidelines for compensation and mitigation of environmental and socio-economic impacts are relatively new in the evaluation of major energy projects in British Columbia, and consequently the principles that should apply are not well established. Before proceeding to the analysis of the project's environmental and socio-economic impacts, the Commission wishes to set out the evaluation principles it has adopted.

1.0 Resource Valuation

Hydro and intervenors presented evidence on the value of the natural resources in the area, both with and without the project. Their findings provided a measure of the project's resource impacts and, in some instances, served as a basis for developing and evaluating mitigation and compensation proposals.

Some intervenors argued that the project's resource impacts cannot be measured quantitatively and that the significance of environmental impacts cannot be reduced to dollar terms. One intervenor, in final argument, stated that "to use a highly capricious variable such as the dollar to measure the real, constant and eternal values of the Peace Valley cannot make sense" (115:18,819). Such measurement could be misleading because of the uncertainty regarding future values and because the value of the Peace Valley as a whole might be significantly greater than the sum of the values of its parts.

Clearly, environmental impacts cannot always be measured in purely quantitative economic terms; some impacts can only be evaluated on a qualitative basis. Thus, the Commission has taken qualitative considerations into account in evaluating impacts. Nevertheless, quantitative resource evaluations are an important component when trying to measure the social costs of a project that affects or 'uses' natural resources. And they are equally important in providing a rational basis for mitigation and compensation decisions. So the Commission has assigned quantitative values to resources insofar as possible.

For quantitative resource valuation to be useful, the forecasts of the demand and utilization variables, which establish the worth of each resource to society, must be as well founded and as accurate as possible. In addition, the procedures and principles used in the calculations must be consistently applied.

The objective of resource valuation is to determine what a resource, in its best or most efficient use, could contribute to society, either in the production of goods, such as hydroelectric energy or agricultural or forest products, or as a final consumer good itself, such as a recreational resource.

Economic rent and consumer surplus are accepted and appropriate measures for evaluating resources.[1] Problems arise, however, in their application. Three key issues arose at the hearings:

1. Should resources be valued on the basis of what they could be worth given their maximum potential or what they would be worth given their most likely future use?

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[1] For those resources that serve as an input to production, a measure of their contribution to society is the economic rent they provide. Economic rent refers to the value of the production made possible by the resource, less the costs of all of the inputs to production other than the resource itself. For those resources that constitute final consumer goods, a measure of their contribution to society is the consumer surplus they provide. Consumer surplus refers to the value that individuals attach to a particular good, service or opportunity less the amount they actually pay for it.

2. For those resources where loss estimates are based on values attached by users (eg. recreational opportunities), should user values be based on their willingness to pay for continued access to the resources or their willingness to be compensated for giving up access to the resource?

3. What discount rate should be used for determining the present value (i.e. the value or significance today) of future resource losses?

1.1 'Maximum' vs. 'Realistic' Resource Use Valuation

Hydro submitted that resource values should be estimated on the basis of what they would be worth in the absence of the project (51:8,177-8). Others, including B.C. Government panels, argued that resource values should be calculated on the basis of maximum utilization, particularly in the context of long-term or irreversible impacts, since once a resource is lost, the opportunity to take full advantage of its potential is also lost. They argued that it is the maximum potential that measures a resource's true value to society even if the full potential would likely never be realized.

Some intervenors were concerned about the unknown potential of the resources that could be lost as a result of Site C. They argued that an option value (that is, provision for future changes in technology or resource availability or other factors that may enhance the value of the resource) should also be taken into account in resource valuation.

The Commission concludes that quantitative resource valuation should not be based on unknown possible future changes in resource use but rather on predictable potential uses. In accordance with the Province's Guidelines for Benefit-Cost Analysis, the Commission concludes that an option value cannot be incorporated into the quantitative valuation of the natural resources lost or adversely affected by Site C, but it can be identified and assessed on a qualitative basis as appropriate.

The Commission concludes that resource valuation should be based on the best estimate of what a resource would contribute to society in its most efficient, practical use. Care should be taken to ensure that the valuation is neither biased upward by unrealistic utilization scenarios, nor biased downwards by assumptions which imply that the most efficient, practical use would not be realized. Therefore, in Chapter XIV, the Commission has valued resources on the basis of what it believes the resources would be worth in the absence of the project if employed in their most efficient, practical use.

1.2 Willingness to Pay vs. Willingness to be Compensated

In developing estimates of the value of various recreational opportunities in the area, Hydro relied on survey estimates of the maximum price that individuals said they would be willing to pay to be able to participate in the activity. The estimated price was taken to be the value of the resource in recreational use.

The alternative approach, estimating what individuals would have to be compensated to forego the opportunity to participate in the activity, is more appropriate if one assumes that the recreational users have a right to continued access to the resource. B.C. Government witnesses argued that the willingness-to-be-compensated approach should be used by the Commission, and they estimated this would result in a doubling of the resource value as compared to that given by the willingness-to-pay approach (101:16,573). Hydro recognized that this approach would result in higher values.

In trying to resolve this issue, the Commission referred to the government's Guidelines for Benefit-Cost Analysis and to the Guidelines for Environmental and Social Impact Mitigation/Compensation. The Benefit-Cost Guidelines suggest that the willingness-to-be-compensated approach to resource valuation should be used in the context of resource loss (Ex 122:37). The argument seems to be that the loss suffered by existing users in giving up access to a particular resource is measured by the price at which they have to be compensated in order to remain no worse off, and that this price should be reflected in the cost of the project.

The Mitigation/Compensation Guidelines (Ex 229), on the other hand, suggest that the willingness-to-pay approach is more appropriate. They imply that resources should be allocated and valued on the basis of the use in which they would be worth the most. The measure of value in this context is what alternative users would be willing to pay the province for access to the resource, not the amount one type of user would have to compensate another to forego use of the resource.

The Commission concludes that the willingness-to-pay approach is based on the premise that the rights to the resource belong to the province. The willingness-to-be compensated approach is based on the premise that one class of users have special rights to the resource. The Commission therefore concludes that unless prior rights have been established through contractual or treaty arrangements, the willingness-to-pay approach for valuing public or crown-owned resources is appropriate. The issue is how much the resources are worth to the province as a whole, not how much they are worth to one class of users. In the resource valuations that follow, the willingness-to-pay approach is used except in the case of impacts on native Indian rights under treaty.

1.3 Discount Rate: Social Opportunity Cost vs. Time Preference

Through the application of a discount rate, future values are reduced at a compounded annual rate to make them comparable to present values. The higher the discount rate employed, the less significant future effects will be relative to present effects.

The Commission concludes that for purposes of valuation of resource loss, it is the social rate of discount, not a private rate, which is relevant. In the context of Hydro's capital expenditures this means applying the social opportunity cost of capital in the evaluations[1].

The question arises as to whether a discount rate based on the social opportunity cost of capital is appropriate for measuring future resource losses. Hydro estimated that, in the context of its investments, the social opportunity cost of capital is 8% net of inflation. The effect of this relatively high discount rate is to place a low weight on future values. While the Commission concluded that discounting on the basis of the relatively high social opportunity cost is appropriate for evaluating capital investment, it may not be appropriate for evaluating resource loss.

Discounting at a rate based on the social opportunity cost of capital is appropriate for capital investment because it reflects the rate of return at which dollars today can be invested. It is because fewer dollars are needed today to accumulate to and therefore be equivalent to a given amount of dollars in the future that one discounts future values.

Various witnesses before the Commission argued that for purposes of resource valuation, the social opportunity cost of capital is inappropriate and that a social time preference rate, or some similar principle, should be used instead.

Social time preference refers to the relative weight that society places on the availability of goods or resources today and in the future. It is usually measured by the rate at which individuals will save (i.e. a measure of the trade-off between present and future consumption). Because it is lower than the rate based on the social opportunity cost of capital, it attaches greater present weight to future resource values or losses. As stated by one government witness:

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[1] For a discussion of the implications of the social opportunity cost of capital on Hydro's investment planning, see Chapter VIII, pp. 98-100).

> when it comes to resource losses that don't involve capital expenditures such as loss of fish and wildlife, we've discussed before intrinsic rather than financial values, then some theories say that the more appropriate discount rate is the social time preference rate, which indicates the preference that,--well, that the present and future generations may place on that resource. And so there's a body of theory that says that the appropriate rate that should be applied in the context of the result of the loss of environmental resources, should be the social time preference rate (103 : 16,962).

Some intervenors argued that future values should not be discounted at all. They suggested that society should be just as vigilant in protecting future resources as it is in protecting present resources. This implies that the social time preference rate is equal to zero.

Government witnesses testified that the province's current guideline for discounting in benefit-cost analyses is under review and that a hybrid procedure incorporating elements of the social opportunity cost of capital and social time preference is being considered. Under this procedure all benefits and costs would be discounted at the lower time preference rate, but those relating to investment would be adjusted to reflect the social opportunity cost of capital.[1] The effect is to give greater weight to future resource losses or other consumption opportunities, including power benefits, while ensuring that the full investment potential of capital expenditures is taken into account.

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[1] More specifically there would be "an adjustment to the costs of a public sector investment to reflect the extent to which it displaces private sector investment" (Ex 277 : 17).

The Commission recognizes the practical importance of the discount rate with respect to resource valuation, and that the rate ought to reflect the weight society attaches to the future availability of natural resources. The Commission accepts Hydro's evidence (30:5,208-9) that the real social opportunity cost of capital in the context of Hydro's investment is 8%. However, the Commission is not satisfied that the social opportunity cost of capital rate by itself appropriately reflects the value that should be placed on future resource losses.

The Commission concludes that, for evaluating resources that will be affected or lost as a result of Site C, appropriate weight must be given to future resource values. The Commission therefore concludes that the hybrid procedure should be used for resource evaluation.

The hybrid procedure requires selecting the social time preference discount rate. The Commission believes that society values present consumption more than an equivalent amount of future consumption and therefore concludes that the social time preferences rate does not equal zero. For purposes of applying the hybrid procedure, the Commission has used a real, social time preference rate of 3% because this reflects the long-term rate at which individuals will save.[1]

The Commission recognizes that the existing provincial government guidelines call for a discount rate based on the social opportunity cost of capital. The Commission, therefore, has also calculated resource losses using this 8% rate in case the Government concludes from its current review that the existing guidelines should stay in force.

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[1] While considerable evidence was presented on the social opportunity cost of capital, little specific evidence was presented on an appropriate social rate of time preference. One witness indicated it is anywhere between 2% and 10% (25:4286). The Commission has selected the rate of 3% because it is generally considered to be a good measure of the long term real rate of interest on relatively risk-free bonds. As such it is a measure of what society as a whole has indicated it is willing to trade off (forego) present for future consumption.

2.0 Mitigation and Compensation

The terms of reference require the Commission to consider and assess proposals for the mitigation and compensation of adverse environmental and social impacts of the project.

Mitigation is defined in the Province's Environmental and Social Impact Compensation/Mitigation Guidelines as "measures taken in the planning, construction or operation of a project with the specific objective of avoiding or reducing adverse environmental or social impacts". Compensation is defined as "payments (in cash or in kind) which are made by the developers (or the party responsible for the impacts) with the objective of redressing or offsetting the losses which occur despite or in lieu of mitigation efforts" (Ex 229:4).

The Guidelines specify the principles that should be used in determining appropriate levels of mitigation and compensation. Mitigation, which is essentially an investment in protecting the natural or social environment from adverse impacts, should be undertaken where the benefits of the measure (the value of the resources saved or the reduction in social costs) exceed the mitigation costs. In other words, mitigation should be undertaken where it is efficient to do so.

Compensation, which is essentially the price that must be paid for adversely affecting the natural or social environment, should be equal or equivalent to the value of the resources lost or to the cost of the social impact incurred. Its purpose, clearly stated in the Guidelines, is to ensure that environmental losses and social costs are fully incorporated into the costs of development.

There was no disagreement at the hearings about the principles and purpose of mitigation. There was disagreement, however, about compensation. Intervenors raised questions on the validity, purpose and the scope of compensation measures.

2.1 Validity and Purpose of Compensation

Many intervenors took the position that financial compensation cannot adequately offset resource losses because environmental impacts cannot be reduced to economic terms. Lost land, for example, cannot be replaced by dollars. Hydro took the position that compensation can offset resource losses and that it should be paid, but only where a regional interest has been affected. In its view, the purpose of compensation is to ensure that regional residents do not suffer a net loss as a result of the project. Hydro did not accept the position that compensation should be paid for resource losses of provincial, but not regional significance, purely for economic efficiency purposes. Payments for impacts of a provincial nature, it argued, are captured by water rentals.

The Commission believes that compensation is an important aspect of project approvals. The Commission recognizes that intrinsic environmental values cannot be quantified; nevertheless, resource losses can and should be evaluated and compensated for to ensure that they are properly recognized and taken into account by project developers. With respect to Hydro's position on compensation, the Commission accepts the view that one function of compensation is to offset negative impacts in the region. Thus, it acknowledges and accepts the recommendation in the provincial Guidelines that compensation funds should, where appropriate, be directed to programs in the region to reduce those losses.

However, the Commission does not accept Hydro's view that this is its only function. The guidelines clearly indicate that the provincial government wants compensation to serve as an efficient control and payment for any resource loss or incremental social cost. To determine appropriate levels of compensation for the resource losses and social costs resulting from Site C, the Commission has followed the principle stated in the Guidelines, namely, that the magnitude of the payment should equal or be equivalent to the magnitude of the loss. Whether the loss is of a purely regional or broader provincial nature is irrelevant; the key point is that the full amount of the loss should be compensated for.

The Commission concludes that water rentals are not an appropriate measure of, or substitute for, compensation. Their function must be seen as one of more general taxation, much like royalties on other energy products, and not as payment for the resources that the project itself consumes.

2.2 Scope of Compensation

A number of intervenors made submissions regarding the need to monitor and compensate for private impacts, including damage to property and livestock.

The Commission concludes that it is important to distinguish between matters of private and public concern. Private issues are those involving individuals who feel that the project has affected his or her personal property or rights. Public issues are those in which Crown resources, or communities as a whole, are affected by the project. The Commission concludes that compensation in relation to private issues is a matter for private negotiation or litigation; it is not a matter to be dealt with under the conditions of the certificate. Civil remedies exist for private impacts.

The resource and socio-economic impact compensation and monitoring issues that the Commission has addressed in the following chapters do not relate to private issues but rather to those of a public nature. The Commission will make no recommendation regarding the appropriate level of compensation to be paid to individuals for private losses. For those public impacts where it is impossible to establish losses prior to construction, resolution through a monitoring program will be recommended. The structure and jurisdiction of this monitoring program are discussed in Chapter XVI.

CHAPTER XIV LAND USE AND ENVIRONMENTAL IMPACTS

1.0 INTRODUCTION

The Site C project will have impacts on the land and aquatic environment in the Peace River Valley, thereby affecting present and potential resource activity in the area. Agriculture, tourism, recreation, wildlife, fisheries, water, heritage and terrain resources will all be affected to varying degrees.

Table 12 summarizes Hydro's estimates of the direct impacts of the project on land as estimated by Hydro. In total, almost 6000 hectares (ha) of land will be directly affected by flooding, construction and transmission line clearing between the dam site, 7 km southwest of Fort St. John, and the existing Site One dam near Hudson's Hope. Flooding will result in the loss of 4600 ha of land -- 3560 ha of river banks and terraces and 1040 ha of islands. Construction of the dam and highway relocation work will affect 422 ha of land. Clearing for the Site One - Site C - Fort St. John transmission line will affect 960 ha of land.

TABLE 12

Direct Land Impacts of Site C Project
(hectares)

Reservoir Flooding		
- Terraces and River Banks	3560	
- Islands	1040	
		4600
Construction		
- Dam	280	
- Highway 29 and access roads	142	
		422
Transmission Line Clearing (Site One-Site-C-Fort St. John)	960	960
Total		5982

Source: Ex. 206:22-3

In addition to these direct impacts, the project will affect the 840 ha of land immediately adjacent to the reservoir between the full supply level (FSL) and the safeline. Also, surrounding lands may be affected by reservoir-induced changes in the microclimate and by changes in land use patterns arising from the project as a whole. Outside the immediate area, clearing for the proposed transmission line between Williston and Kelly Lake will affect 1150 ha of land (Ex 242).

With respect to the aquatic environment, the project will affect the habitat and water quality characteristics of over 100 kilometers of the Peace River and its tributaries (with a surface area of approximately 3,400 ha). Water quality downstream of the dam site might also be affected in terms of changes in temperature, turbidity and other characteristics.

This chapter presents the evidence and the Commission's conclusions on the nature, extent and significance of the project's land use and environmental impacts. Information developed on resource values is used to assess the significance and magnitude of the resource losses. In accordance with the terms of reference, the Commission has assessed the opportunities and measures proposed for mitigation and compensation.

2.0 IMPACTS ON CLIMATE AND AGRICULTURE

2.1 Hydro's Position

Hydro's climate consultant indicated that the project would have some small impacts on air temperature and wind speed in the immediate vicinity of the reservoir and on fog and frost occurrence. The consultant indicated that:

- air temperature would be affected less than 1° C for the daily maximum and 0.5° C for the daily minimum and daily means;

- the temperature impacts would become negligible beyond 600 meters from the reservoir (Exhibit 383B);
- wind speed would increase by about 10% over and near the reservoir;
- fog density would increase at nights from late summer to early winter; the number of days with fog might increase one or two days each month, with effects extending to all remaining terraces in the Valley;
- frost risk could increase in early spring and late fall in localized areas, but in fall increased fog might offset this effect;
- rainfall and snowfall would not be affected.

Regarding effects of the climatic changes on agriculture, Hydro's consultant estimated that the number of growing degree days[1] might be reduced by 48-80 (51:8,223-5). Currently, the Canada Land Inventory data indicate that the Peace Valley has 1,310 to 1,504 growing degree days (50:8,013). Hydro's agricultural consultant concluded that any reduction of less than 100 growing degree days would be insignificant for crops typically grown in the Site C area but that existing data is too imprecise to determine the impact on other crops (51:8,209).

Crop drying conditions would deteriorate slightly due to changes in fog density and occurrence (Ex 383B). However, Hydro's consultants concluded that these effects would not be significant (49:7,953).

Hydro's consultants agreed that higher humidity and wind and lower mean temperatures could adversely affect bee activity, and consequently, clover and alfalfa production (50:8,105-6). They also agreed that increased windchill could result in additional cost to the producer for animal feed and shelter.

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[1] Growing degree days refer to an accumulated measure of the extent to which the average daily temperature exceeds a preset standard, in this case 5° C.

Hydro did not propose compensation measures for climatic impacts since it regards such impacts as negligible. However, Hydro agreed that compensation for any such impacts would be less costly than monitoring to determine whether they in fact occur. It also agreed in principle that crop drying facilities might be an appropriate compensation measure (51:8,311-3).

The principal impacts on agriculture would result from the loss of land due to flooding and construction. Hydro estimated that:

- 2624 ha of land with agricultural significance[1] would be flooded, of which 1642 ha are suitable for vegetable cultivation, 333 ha for vegetables or alfalfa, 192 ha for alfalfa or grain and the remaining 457 ha for pasture lands (110:17,958-60);
- 240 ha of land with agricultural significance would be disturbed by the construction, of which 40 ha would be permanently alienated (110:17,916-57);
- 80 ha of agricultural land would be affected by the relocation of Highway 29 (Ex 136 and Ex 137);
- 730 ha of agricultural land would be affected by the transmission line right-of-way from Site One to Fort St. John (Ex 194).

In addition, some secondary impacts around the reservoir would result from sloughing and erosion as well as from parcels being broken up by the reservoir or safeline. The sloughing impacts are expected to be small (47:7534-40). The breaking up (fractioning) of parcels could affect over 240 ha of agriculturally significant land, but is amenable to mitigation (Ex 195).

Hydro indicated that the class 1-3 agricultural land that would be permanently lost as a result of Site C represents 18% of the class 1-3 lands of the Peace Valley, 0.6% of the Peace-Liard Region, and 0.2% of the province (Ex 195: Table S-1).

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[1] Hydro's agricultural consultant determined agricultural significance on the basis of soil class and parcel size for alluvial soils and on the basis of Canada Land Inventory maps for non-alluvial soils.

Hydro's consultants calculated that a medium-sized processing plant would need 2,200 ha of land; and the fresh vegetable market, given the most optimistic assumptions, would require 840 ha of land by 1996 (Ex 195). Hydro concluded that agricultural land remaining after Site C would be more than sufficient to meet the needs of both the vegetable processing plant and a fresh vegetable market (Ex 196).

For purposes of the Site C benefit-cost analysis, Hydro's consultants estimated the economic value of the agricultural land that would be lost as a result of the project due to flooding, highway relocation, construction, and broken parcels. They also calculated a net return, or economic rent, on the basis of the assumed mix of crops that would be grown on the land, their costs of production and their selling prices. The present value of all future rents foregone as a result of the project provided the measure of the economic value of the land.

Hydro's consultant stated that, for this calculation, he chose crops that are either already being grown in the area or are highly suitable for the valley's soil and climate (47:7,565). They included cabbage, cucumbers, potatoes, sweet corn, lettuce, turnips, silage corn, alfalfa, grain and pasture. He used these crops in three scenarios of future vegetable market demand.

The first scenario assumed only local sales of vegetables, as is now the case, and 40 ha in vegetable production. The second scenario assumed expanded sales to the Peace River Region, Prince George, Fort McMurray and the northeast coal area and 80 ha in vegetable production. The third scenario contained no market constraint and assumed vegetable production in all suitable soils (over 2,000 ha) (44:7,123-4).

Because of transportation and other constraints, Hydro's consultant considered the second scenario to be the most realistic. On this basis, Hydro estimated that the value of the agricultural lands lost due to the project would be

$52.3 million at a 3% discount rate, $19.9 million at a 6% discount rate and $8.2 million at a 10% discount (Ex 106, medium value).

Hydro's consultants made a number of recommendations for mitigating the project's impacts on the regional agricultural resource. With respect to transmission line development, they recommended that new towers be placed close to existing rights-of-way, and on cultivated land, that they be placed in step with existing towers; construction activities be minimized during growing and harvesting seasons; and programs be maintained for seeding pasture grasses and controlling weeds on rights-of-way (Ex 194 : 35-6). It was recommended that highway segments made unusable by the relocation should be removed (45 : 7,220-2). Hydro also suggested that broken parcels should be amalgamated wherever physically possible (Ex 48 : 17-9). With respect to the suggestion that topsoil be removed, Hydro stated that, with the exception of a few areas, the cost would be too high to justify it (51 : 8,305).

Hydro indicated that all land temporarily affected by construction will be reclaimed and returned to its original use. The reclamation plan will be reviewed by various agencies including the Agricultural Land Commission (45 : 7,215-18). Hydro recognized the importance of land use planning to ensure the best use of agricultural land in the Peace Valley not required for the project. It agreed to fund any incremental project-induced cost of land use planning.

With respect to compensation for lost agricultural land, Hydro is prepared to pay the market price for all private lands required for the project. But it is not prepared to pay compensation for undeveloped Crown lands; it argued that the market value for such lands is close to zero after costs for development are deducted (Ex 209). Hydro calculated that from a theoretical social point of view, the agricultural resource loss on Crown land would amount to $2.4 million, using an 8% discount rate (Ex 254). However, Hydro maintained that compensation of that amount is not warranted, since the loss is not of direct regional significance. Hydro did not accept the principle of compensation for strictly economic efficiency purposes.

2.2 The Issues

2.2.1 Physical Impact Issues

Climate

Both the Ministry of Environment and the Ministry of Agriculture and Food agreed with results of the climatic impact study done by Hydro's consultant (89 : 14,479). The major area of controversy was not the impact of the project on climate, but rather the effect of the climatic impacts on agriculture, the dominant issue being the effect of the expected increase in fog on crop drying.

Many intervenors expressed skepticism about Hydro's conclusion that the impacts on crop drying will be negligible. They argued that fog and increased humidity will cause longer drying time and may cause crop deterioration or even crop loss. If crops do deteriorate, prices will decrease, resulting in economic loss (Ex 307, Ex 289L).

Other climatic impact issues were raised. The Ministry of Environment pointed out that a decrease of 50 to 100 growing degree days would definitely lower the affected agricultural land from Class 1 climate to Class 2 (89 : 14,479-80). And the Peace Valley Environmental Association presented evidence indicating that decreased temperature can affect yield and ripening time of many crops (95 : 15,598-9).

Some of the intervenors argued that increased wind will increase the cost of farm operations due to the need for additional food and shelter for domestic animals (75 : 11,067). Evidence was also given that increased wind can reduce yields of many crops (95 : 15,599-600).

The Ministry of Agriculture and Food stated that there is no widely accepted method of determining and quantifying these climatic effects on agricultural production (Ex 215 : 4).

The Commission concludes that, while the impacts of the project on climate and the consequent effects on agriculture are uncertain, they are likely to be relatively small and limited in extent. Nevertheless, the Commission recognizes that they could be significant to some farmers in the Valley. THE COMMISSION RECOMMENDS THAT THE MINISTRY OF AGRICULTURE AND FOOD GIVE THESE CONCERNS, PARTICULARLY THOSE RELATED TO CROP DRYING, HIGH PRIORITY WHEN DEVELOPING AGRICULTURAL COMPENSATION PROGRAMS FOR THE REGION. THE COMMISSION RECOMMENDS THAT NO CLIMATE-RELATED CONDITIONS BE IMPOSED ON HYDRO OR BE REFERRED TO MONITORING.

Agricultural Land

In estimating how much land affected by the project is of agricultural significance, Hydro's consultant excluded alluvial soils of class 4-7 and small land parcels (parcels of less than 10 ha on the north shore and parcels of less than 20 ha on the south shore, island and tributaries). In addition, he used unimproved capability ratings. Each of these assumptions was questioned at the hearings.

Some intervenors, including the Ministry, pointed out that given the Class 1 climate, Class 4, 5 and even 6 lands are valuable and should not have been excluded from the estimate of the agricultural resource impact (86:13,914-22).

Some intervenors criticized Hydro's use of unimproved capability ratings. They noted that improved ratings will affect not only the evaluation of productivity, but also the range of crops that can be grown (98:16,136). But Hydro's consultants argued that very few acres would be improved by drainage and less than 80 ha would be improved by irrigation (48:7,724-5).

The Ministry of Agriculture and Food considered Hydro's parcel size criteria to be reasonable. However, several other intervenors argued that due to the high productivity of the land, small parcels are significant for intensive cultivation (98:16,119-20) and that viable market gardens near Taylor are only between 4.8 ha and 7.2 ha in size (79:12,662-4).

The adequacy of soils mapping and data interpretation were questioned, and the conclusions regarding soil quality drawn from the consultants' 1:12,000 mapping of alluvials were considered inadequately supported (96:15,713-4).

The Commission believes that the assumptions and criteria employed by Hydro's consultants may understate somewhat the full potential of the agricultural resource in the area affected by Site C, since some Class 4 to 6 soils might be of agricultural significance. Nevertheless, the Commission concludes that such exclusions are relatively small and that the 2960 ha of potential agricultural land that Hydro's consultants identified provides a reasonable basis for estimating the agricultural resource loss.

The Ministry of Agriculture and Food agreed with Hydro that sufficient land would remain in the area after Site C to support a viable vegetable processing industry. But it pointed out there would be extra costs as a result of the project. The alluvial soils downstream from Site C have poorer access to transportation and are not as well serviced. Also parcels of land tend to be small and thus less amenable to mechanized development (86:14,035-154).

Intervenors argued that the flood reserve and the absence of large blocks of land downstream from Site C would make agricultural development difficult and that the loss of four major alluvial flats in the Site C area would effectively preclude a vegetable industry (77:12,309-13).

Many intervenors held that lifting of the flood reserve downstream of Site C was essential to protect and enhance the remaining agricultural and related processing industry potential in the region. If the flood reserve is to remain, they recommended that the cancellation clause be substantially extended. Hydro indicated it is in favour of lowering the flood reserve to the 419.1 m level, which is the maximum height required for Site E if Site C is built. But it opposed complete removal of the flood reserve below Site C until it has the opportunity to make further representations to Cabinet on the value of the Site E project for the production of power (40 : 6,447-8).

Some intervenors also argued that, after Site C, pressure on agricultural land for non-agricultural purposes would be intense and likely result in further losses (95 : 15,591).

The Commission concludes that the Site C project will not in itself preclude the development of a vegetable processing industry in the region, but in conjunction with the maintenance of the flood reserve below Site C, such development might well be precluded. THE COMMISSION THEREFORE RECOMMENDS THAT THE FLOOD RESERVE BELOW SITE C BE REMOVED BY CABINET SINCE, WITHOUT SUCH A MEASURE THE POSSIBILITY OF FURTHER AGRICULTURAL RESOURCE LOSS IN THE REGION WOULD REMAIN AND CONTINUE TO INHIBIT AGRICULTURAL AND RELATED PROCESSING DEVELOPMENT.

2.2.2 Agricultural Valuation Issues

Many intervenors expressed dissatisfaction with the assumptions Hydro used in estimating the value of the agricultural resource loss. It was pointed out that Highway 29, much of which is already developed, provides access to the Site C alluvial soils, and that the potential markets for vegetables grown in the area could expand substantially beyond what Hydro assumed in its "most likely" scenario (77 : 12,309-22; 79 : 12,663-98). In addition the consultant's choice of crop mix was considered limited (95 : 15,602).

Intervenors also argued that, because of the flood reserve, long-term investment in agricultural development has been severely inhibited (79:12,640; 85:13,969) and that since Hydro's evaluation was based in part on current patterns of development, its estimates understate the full potential value of the resource. While acknowledging that the flood reserve could have affected agricultural growth to some extent, Hydro argued that the main impediment was not the flood reserve but rather problems of access, and wildlife and grazing reserves (47:7,651-5).

The Ministry of Agriculture and Food presented the only alternative estimates of the value of the agricultural resource loss. Whereas Hydro's estimates ranged from $8 million to $52 million, depending on the discount rate, the Ministry's estimates ranged from $17.5 million to $94.5 million, using a similar range of discount rates.[1] The Ministry calculated that for just the Crown agricultural land lost to flooding,[2] the value of the resource loss would range, depending on the discount rate, from $5.6 million to $38.5 million; Hydro estimated the loss on Crown land would range from $1.5 million to $3.8 million (Ex 254). Neither the Ministry nor Hydro estimated the loss on Crown land from construction, highway relocation and broken parcels.

Hydro's and the Ministry's resource loss estimates differ because of the different assumptions they each adopted with respect to the key factors which underlie the value of the land. These factors are (1) the percentage of land allocated to the high-valued vegetable production as opposed to other crops; (2) the net annual return on the different types of agricultural production; and (3) the rate of increase in crop prices and net economic return over time.

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[1] Both the Ministry's and Hydro's low estimates are based on a 10% discount rate. Hydro's high estimate is based on a 3% rate, whereas the Ministry's is based on a hybrid procedure, which gives an effective rate of between 4% and 5%. Had the Ministry used a 3% rate, its high estimate would have been greater than $94.5 million.

[2] For its calculations, the Ministry assumed slightly over 1,000 ha of Crown land would be lost due to flooding (Ex 215A). The Ministry subsequently indicated that the loss of Crown land would amount to approximately 800 ha (113 : 18,394).

The Ministry assumed a greater amount of vegetable production than Hydro---400 ha on the total land base, and 133 ha to 200 ha on the Crown land, compared to Hydro's 80 ha on the total land base, none of which would be on Crown land.

The Ministry assumed higher net returns of $3,337.5 and $262.5 per ha for vegetables and other crops, respectively, compared to Hydro's $1,089 per ha and $154 per ha, respectively. The Ministry's net return figures, it should be noted, do not incorporate capital costs, which were deducted separately. Nor do they include a 12.5% risk factor by which Hydro had reduced the net return. These differences, plus other adjustments that the Ministry considered necessary to capture social as opposed to private benefits and costs partly explain the differences between the Ministry's net return estimates and Hydro's.

Both the Ministry and Hydro assumed that crop prices would increase at 1% per year, which would result in the net economic return increasing at a rate of 2.5% per year. But for its calculation of losses on Crown land, Hydro assumed the net economic return would increase at only 1% per year.

The Commission recognizes that it is difficult to determine how the agricultural land in the area affected by Site C might develop in the absence of the project and what it would be worth. Nevertheless, the Commission concludes that its worth must be estimated so it can be taken into account in project evaluation and compensation.

The Commission concludes that in evaluating the agricultural land that would be lost as a result of Site C, the following assumptions are appropriate:

- *that 2,960 ha of agricultural land would be lost and of this total 400 ha would go to vegetable production yielding a net average annual return of $3,337.50 per ha , and the remaining 2,560 would go to other crop production yielding a net average annual return of $262.50 per ha;*

- that 800 ha of Crown agricultural land would be lost as a result of flooding, of which 133 ha would go to vegetable production and the remaining 664 ha would go to other crops, with the same net average returns as for the total land base;
- that the net average annual return would increase in real terms at a rate of 1% per year;
- that capital and clearing costs, as estimated and described in the Ministry's submission, must be deducted in calculating the net value of the land.

On the basis of these assumptions, the Commission calculates a total agricultural resource loss of $59.8 million using the hybrid procedure discussed in Chapter XIII, and $24.0 million using an 8% discount rate. The loss on Crown land alone due to flooding would be $18.6 million and $7.4 million, using the hybrid procedure and 8% discount rate respectively.[1] The Commission cannot determine how much Crown agricultural land would be lost due to other impacts since no data on their magnitude was presented at the hearings.

While these figures appear relatively high, they are by no means the maximum. Not all of the agricultural land loss is taken into account (at least with respect to Crown lands) and the assumed potential vegetable production is far less than its maximum potential. Also the real escalation is less than the rate both Hydro and the Ministry indicated was possible. The estimates reflect, in the Commission's view, a measure of loss that takes the practical, efficient potential of the resource into account.

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[1] In this report resource losses are calculated on the assumption of a 1985 issuance of an Energy Project Certificate. Losses are discounted back to that year, but are reported in 1981 dollars. If the issuance of an Energy Project Certificate is deferred beyond that date, the loss estimates would have to be recalculated to take into account real changes in resource values.

These loss estimates do not take into account transmission line effects. The Commission concludes that as long as rights-of-way are not taken out of production and appropriate mitigation measures are taken, their overall impacts should be minimal.

Many intervenors argued that the value of agricultural land cannot be measured solely in terms of the land's potential development. Some argued that the true value of that land may only become apparent in the future when food shortages are imminent, and that this potential future "option" value has not been appropriately considered and taken into account. Some intervenors stated that agricultural lands are shrinking due to urban development, erosion and deterioration of soils, and that foreign imports of food are not secure sources of food supply (79:12,575-80; 95:15,568-79). The Ministry's view is that it is difficult to estimate how the loss of Site C will affect future food supply. It was suggested that problems of food supply for B.C. probably will not occur until after the year 2000 (86:13,955). Others, including Hydro and the local MLA, argued that there will be more than enough land left after Site C to provide for food needs as well as a viable vegetable industry (Ex 164).

The uniqueness of the land in Site C for agricultural production was discussed at length. It was pointed out that the alluvial soils are ideal for vegetable production and that the Site C valley is warmer, has a longer growing season, less wind, more productive soils and access to water year-round. The class 1 climate enhances all soils, including the lower capability land (79:12,625-80; 98:16,123-4). The Ministry testified that the valley soils would not require liming for the next 30 years, and that the high productivity and microclimate of the lands are unique in northern B.C. and should be taken into account in the valuation (84:13,942-7; 89:14,464-77).

The Commission concludes that the unique qualities of the land affected by Site C cannot be meaningfully quantified in any theoretical calculation of its special value. Nevertheless, the Commission, in its valuation above, did give credit to very significant development potential. Moreover, while the Commission recognizes that land can never be replaced, agricultural productivity on other lands can be increased. The Commission concludes that compensation programs designed to improve and intensify agricultural production on the remaining lands are important and should be undertaken to try to ensure that appropriate levels of food production are attained in the province.

2.2.3 Mitigation and Compensation Issues

Hydro recommended a number of mitigation measures to minimize the adverse agricultural resource impacts, but with respect to the major issue of compensation for lost agricultural land, it argued that none should be paid. Hydro argued that payment of market value was fair compensation for the privately held lands and that the regional loss on Crown lands would be zero because of the cost of development. The theoretical net social loss to the province, Hydro argued, did not warrant compensation.

The Ministry of Agriculture and Food disagreed. The Ministry argued that in accordance with the province's Mitigation and Compensation Guidelines, full compensation for the value of lost Crown agricultural land should be made. The Ministry did not argue for compensation of the social loss on privately held lands.

Many intervenors questioned Hydro's position that there should be no compensation for Crown lands. They also argued that the market value is an inadequate measure of the value of privately-held agricultural land.

The Ministry presented a set of options on how compensation funds could be used to enhance the productivity of the lands remaining in the region after Site C to offset the loss of high capability lands. The options included:

- regional agriculture research and demonstration projects at a cost of $2.5 million;
- expansion and improvement of the agricultural land base at a cost of $2.6 million;
- assistance to farmers to purchase lime supplies at a cost of $7.9 million;
- assistance to farmers to purchase grain drying systems at a cost of $2.6 million;
- development of 2,000 ha of Crown land for pasture at a cost of $0.5 million;
- rural electrification at a cost of $3.3 million;
- assistance to purchase power converters at a cost of $0.4 million;
- access to natural gas for Peace River farmers and rural residents at a cost of $7.1 million (Ex 215A).

The Commission was asked to advise on the general direction for compensation, leaving the details to be worked out by the Ministry in cooperation with all relevant and interested parties (88 : 14,400).

The B.C. Federation of Agriculture, in general agreement with the Ministry's proposals, recommended that compensation payments be made and earmarked for enhancing regional agriculture development. The B.C. Federation of Agriculture recommended that an agricultural working group, consisting of local farming communities, be set up to work with the Regional Resource Management Committee, the Regional District and Hydro to discuss issues related to secondary impacts, mitigation, planning and management of compensation funds. (Exhibit 398A)

THE COMMISSION CONCLUDES THAT THE FOLLOWING MITIGATION MEASURES OUTLINED BY HYDRO ARE APPROPRIATE AND RECOMMENDS THEY BE MADE CONDITIONS OF THE ENERGY PROJECT CERTIFICATE. FOR TRANSMISSION LINES,

- ***PLACE TOWERS ADJACENT TO ROADS OR EXISTING RIGHTS-OF-WAY;***
- ***PLACE TOWERS IN STEP WITH EXISTING TOWERS ON CULTIVATED LAND;***
- ***SCHEDULE WORK TO MINIMIZE ACTIVITY DURING GROWING AND HARVESTING SEASON;***
- ***MANAGE THE RIGHT-OF-WAY FOR GRAZING OR OTHER AGRICULTURAL USE IN CONJUNCTION WITH ADJACENT AGRICULTURAL USE; AND***
- ***MANAGE WEEDS, AND IN PARTICULAR KNAPWEED, IN AREAS ADJACENT TO AGRICULTURAL LAND, MINIMIZING HERBICIDE USAGE.***

REGARDING MITIGATION FOR OTHER AREAS, THE COMMISSION RECOMMENDS THE FOLLOWING:

- ***DISTURBED AGRICULTURAL LAND SHOULD BE RETURNED TO ITS ORIGINAL USE, WITH RECLAMATION PLANS REVIEWED BY VARIOUS AGENCIES INCLUDING THE AGRICULTURAL LAND COMMISSION;***
- ***FRACTIONED PARCELS SHOULD BE AMALGAMATED WITH ADJACENT AGRICULTURAL UNITS WHEREVER PHYSICALLY POSSIBLE; AND***
- ***AGRICULTURAL LAND OWNED BY HYDRO SHOULD BE MAINTAINED IN THAT USE.***

The Commission recognizes the importance of the development of a land use plan to minimize secondary impacts on remaining land. ***WHILE THE COMMISSION CONCLUDES THAT THIS IS NOT A RESPONSIBILITY OF HYDRO THE COMMISSION RECOMMENDS THAT THE APPROPRIATE***

GOVERNMENT MINISTRIES UNDERTAKE DEVELOPMENT OF A LAND-USE PLAN AND THAT HYDRO, AS A CONDITION OF THE ENERGY PROJECT CERTIFICATE, PAY FOR PROJECT-INDUCED INCREMENTAL COSTS OF ITS DEVELOPMENT. MOREOVER, THE COMMISSION RECOMMENDS THAT HYDRO PARTICIPATE IN THE PLAN'S DEVELOPMENT AND BE SUBJECT TO IT IN MANAGING AND MAINTAINING LANDS IT OWNS THAT ARE NOT REQUIRED FOR PROJECT OPERATION.[1] *THE COMMISSION ALSO RECOMMENDS THAT IF THE LAND-USE PLAN IDENTIFIES AREAS WHERE TOPSOIL REMOVAL IS APPROPRIATE AND COST EFFECTIVE, HYDRO UNDERTAKE THIS MITIGATION MEASURE.*

With respect to compensation for the agricultural resource loss, the Commission does not accept Hydro's argument that compensation for lost Crown land is not warranted. The Commission concludes that such compensation is appropriate and indeed is essential to ensure that the full costs of the project are borne by Hydro's customers. It agrees with the Ministry of Agriculture and Food that the funds should be used to enhance agricultural productivity in the region.

THE COMMISSION RECOMMENDS THAT CONSISTENT WITH ITS VALUATION CALCULATIONS, B.C.HYDRO BE REQUIRED TO PAY TO THE GOVERNMENT $18.6 MILLION (IN CONSTANT $1981) AS COMPENSATION FOR THE LOSS OF CROWN AGRICULTURAL LAND FROM FLOODING.[2] *THE COMMISSION RECOMMENDS THAT THESE FUNDS BE DEDICATED TO AGRICULTURAL PROGRAMS IN THE REGION, AND THAT A PLANNING COMMITTEE, AS RECOMMENDED BY B.C. FEDERATION OF AGRICULTURE, BE ESTABLISHED TO ADVISE ON THE MOST APPROPRIATE MIX OF PROGRAMS FOR THE REGION. ULTIMATE AUTHORITY SHOULD REST WITH THE MINISTRY OF AGRICULTURE AND FOOD.*

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[1] It should be noted that the impacts which would result should Hydro not allow other land uses on their property have not been assessed, but could be substantial.

[2] The actual payment should reflect the rate of inflation between 1981 and the year when the compensation is paid.

THE COMMISSION RECOMMENDS THAT HYDRO NOT PAY COMPENSATION FOR SOCIAL LOSSES ON PRIVATELY HELD LAND. The Commission recognizes that there is a social loss over and above the private loss on these lands and sees the Agricultural Land Reserve Act to be a result of concern over such losses. However, because no guidelines exist regarding compensation for the social loss on private lands transferred out of the agricultural land reserve, the Commission concludes that compensation from Hydro should not be required.

With respect to mitigation of impacts resulting from the relocation of Highway 29, the Ministry of Highways agreed to fence the rights-of-way in consultation with landowners, to rehabilitate unused old highway sections, to place rights-of-ways as close as possible to valley sides or the reservoir, to preserve and improve drainage patterns and to rehabilitate disturbed agricultural land. It also agreed to consider cattle underpasses on a case-by-case basis. The Ministry of Agriculture and Food stated that it assumed that its field staff will be consulted when the Ministry of Highways develops the various mitigative measures (86:13,972-6). The issues of cattle underpasses and fencing were stressed by intervenors whose lands will be affected by the relocation of Highway 29. One affected intervenor recommended that the new route be located along the existing rights-of-way (81:13,024). Others suggested that an independent agricultural review be undertaken to ensure that problems of access, movement of livestock, drainage, fencing and parcel fragmentation are resolved before the new highway route is established (Ex 398A:3).

The Ministry of Highways indicated that it would complete the designs and route of the highway once it was clear that flooding of the existing highway was imminent.

The Commission realizes that relocating Highway 29 could have significant impacts on landowners directly in the path of the new highway. The Commission notes, however, that the relocation will be undertaken by, and be the responsibility of, the Ministry of Highways. So it does not recommend any conditions be imposed on Hydro respecting highway relocation.

THE COMMISSION RECOMMENDS THAT THE MINISTRY OF HIGHWAYS FOLLOW THE PROCEDURES AND PRACTICES IT DESCRIBED AT THE HEARINGS, EXCEPT THAT FINAL DESIGN NOT BE DELAYED UNTIL CONSTRUCTION IS IMMINENT. The potential relocation of Highway 29 has already been known for some time and has caused considerable concern to affected landowners. In light of the possibility for future delays of this project, the Commission considers it desirable to provide local residents with a definitive plan as soon as possible. THE COMMISSION THEREFORE RECOMMENDS THAT IF AN ENERGY PROJECT CERTIFICATE IS ISSUED THE MINISTRY OF HIGHWAYS, IN CONSULTATION WITH AFFECTED LANDOWNERS AND OTHER GOVERNMENT AGENCIES, IN PARTICULAR THE MINISTRY OF AGRICULTURE AND FOOD, ESTABLISH A DEFINITE ROUTE FOR THE HIGHWAY AND MAKE THAT DETERMINATION PUBLIC AS SOON AS IT IS AVAILABLE.

3.0 IMPACTS ON FORESTRY

3.1 Hydro's Position

Hydro's forestry consultant indicated that approximately 3,824 ha of productive forest land would be lost due to flooding (Ex 198 : 14). An additional 1,150 ha of forest land would be cleared for the Williston-Kelly Lake line (Ex 231) and 705 ha for the Site One-Fort St. John transmission line (Ex 194). He estimated that, because of the lost forest land due to flooding, the annual allowable cut would decrease by about 8,400 cubic meters per year (Ex 198). On the basis of an estimated average stumpage value of approximately $4 per cubic meter, the annual loss would be $32,560. The present value loss over the life of the project would be $356,420 at a 10% discount rate; $480,690 at a 6% rate and $1,024,000 at a 3% rate.

Hydro indicated that the reservoir area will be cleared for aesthetic and recreational reasons below elevation 461.8 meters except for a small proportion that would be difficult to clear. Even in the areas that are difficult to get at, trees with tops protruding above an elevation of 457 meters will be cleared. Most of the estimated 274,000 cubic meters of merchantable timber below this elevation will be salvaged; its value would offset a small part of total clearing cost (Ex 201:10). All non-merchantable timber will be cleared. Along potential recreation sites stumps will be removed between elevations of 457 meters and 461.8 meters (Ex 198: Appendix IIIB). While no breaks in forest cover will be visible along the shoreline, provision will be made for additional clearing in areas where wind or sloughing may cause trees to fall (51:8,296-8). Debris from clearing will be removed in the construction phase. Clean up of debris will require at least two seasons after flooding. An allowance of about $1 million has been made for this work (Ex 198:22). In later years, a maintenance and clean-up program will be instituted to ensure that the use of the reservoir is not materially affected by debris (37:6,742-3).

Hydro argued that the forestry loss need not be compensated because much of the forests are in non-marketable deciduous stands and the coniferous stands are scattered and uneconomical to harvest. Hydro noted that licensees in the region have not considered the area accessible and that, in any event, the total volume of wood that could be developed is insignificant in the regional context (Ex 198:20-7). Hydro indicated that stumpage will be paid on merchantable timber removed from the reservoir and that this will be approximately equal to the present value of any social loss (Ex 209).

3.2 The Issues

3.2.1 Physical Impact Issues

While Hydro's forestry consultant identified over 3,800 ha of productive forest land in the reservoir area, the Ministry of Forests suggested that only 1,724 ha of this land could be expected to remain as part of the commercial forest land base if there were no Site C project (Ex 226:6). The Ministry pointed out, however, that the displacement of agriculture, wildlife, and human settlement will have secondary effects on other forest lands in the region (70:11,360-3) and that spring and fall grazing on seven ranching operations will be affected by impacts on Crown range land (Ex 226:8).

The Ministry testified that the potential impact of the Williston-Kelly Lake transmission line on forest and range land remains unclear because the data supplied by Hydro is inadequate (70:11,339-40). However, the Ministry did say that, if the transmission lines were located on productive growing sites, the forestry losses could be even greater than in the reservoir area (70:11,353).

Several intervenors expressed concerns over both Hydro's and the Ministry's impact estimates. The Association of Professional Forestors argued that the Ministry's estimate of 1,724 ha of forestry land base is low because much of the land on the north side is more valuable for forestry than present agricultural uses (Ex 405:3-4) and because the isolated patches of timber on the south shore and islands could be accessible in the future from private lands (100:16,423-4). The Association also expressed concern regarding the cumulative alienation of the forest base over time and the loss of any opportunity to increase forest harvests and values through intensive management on the lost land (100:16,412).

The Commission concludes that, for purposes of valuing the forestry resource loss due to flooding, the Ministry's estimate of 1724 ha is appropriate. The larger Hydro estimate includes land of agricultural significance that has already been taken into account in the estimate of the agricultural resource loss, so including it here would result in double-counting the potential resource losses.

The Commission notes that the 1724 ha loss applies only to flooding; it does not reflect the forestry resource loss due to transmission line development. The Commission concludes that the absence of adequate data on the transmission line impacts, particularly with respect to the Williston-Kelly Lake line, is a deficiency in the application, and should be rectified prior to the issuance of an Energy Project Certificate.

3.2.2 Valuation Issues

In calculating the forestry resource loss, Hydro assumed a reduction in the annual allowable cut of 8,400 per cubic meter and a stumpage value of approximately $4/per cubic meter. The Ministry of Forests used a different set of assumptions. Because it assumed a smaller forest land base would be affected, it calculated a smaller reduction in the annual allowable cut (4,736 per cubic meter). But it estimated the value of the timber at $6 per cubic meter, taking rent, corporate income and logging taxes into account. In addition, it assumed a one-time value for the loss of cutting rights at $25 per cubic meter.

With these assumptions, the Ministry produced a slightly higher estimate of the forestry resource loss due to flooding than Hydro's consultants. According to the Ministry, the present value loss ranges from $414,000 to $1,072,000 depending on the discount rate, as compared to Hydro's $356,000 to $1,024,000 based on the same discount rate range.

Although it was suggested that as many as 20 future jobs could be lost due to Site C and related transmission impacts (70: 11,365) the Ministry did not include these losses in its calculations. The Ministry stated that the estimated loss in annual allowable cut would not significantly disrupt sawmills in the region because it constitutes a minor proportion of the total cut available to them (Ex 226: 7).

The Association of B.C. Professional Forester's argued that the value of the compensation for lost forest land should be based on the cost of replacing its growing potential, not on its present worth (15,410-412). Mr.Rutledge also pointed out that the values of forest land for wildlife, recreation, fuel, and as a climate modifier have not been accounted for in any of the estimates (50:8,063).

The Commission concludes that the assumptions employed by the Ministry are appropriate for estimating the forestry resource loss due to flooding. Based on these assumptions, the Commission calculates a present value loss of $1.0 million using the hybrid procedure and $0.5 million using an 8% discount rate. The net loss to the province would be this amount less the present value of the stumpage collected from clearing. The Commission emphasizes that this is the loss due to flooding alone; it does not include the loss resulting from the transmission rights-of-way.

3.2.3 Mitigation and Compensation Issues

Clearing is a major mitigation expense for Hydro, aimed at salvaging merchantable timber and at enhancing the recreational potential of the reservoir. Two primary issues were identified regarding clearing; first, the general cutting standards that should pertain for the reservoir as a whole; second, the extent and nature of shoreline clearing.

Hydro acknowledged that its proposal to cut all accessible trees growing below the 461.8 meter level and all trees, whether readily accessible or not, whose tops extended above the 457 meter level might still allow the remaining trees to interfere with fishing lines. Hydro indicated that lowering the maximum height of the tops of the uncleared inaccessible growth to the 452 meter level would cost about $130,000.

Hydro indicated that it will clear the shoreline in a manner consistent with the Ministry of Forests' specifications. Hydro anticipated that these specifications will require it to leave all trees above the full supply level line as had been required for the Site One reservoir. The Ministry of Forests indicated that it had not yet determined specifications for Site C but indicated no reason that there will be a substantial difference from Site One. The Ministry of Lands, Parks and Housing and the Ministry of Environment both indicated that shoreline configuration was of interest to them but neither accepted direct responsibility for designing specifications for it.

The Commission concludes that the appropriate general reservoir clearing standard is to remove all accessible timber below 461.8 meters and all growth, whether readily accessible or not, extending above the 452 meter level of elevation. The Commission concludes that the recreational benefits to be gained by this measure justify the expenditure of an additional $130,000.

Respecting shoreline clearing, the Commission concludes that, generally, recreational potential can best be maximized by making the shoreline as much like that of a natural lake as possible. This will tend to be the most aesthetically pleasing and the most suitable for wildlife. This potential can be further enhanced by selective clearing to maximize access for recreational use.

Responsibility for standards governing the shoreline conditions is not and should not be the responsibility of Hydro. While the Ministry of Forests has direct responsibility for clearing standards, the Ministry of Lands, Parks and Housing and the Ministry of Environment should be consulted regarding appropriate clearing specifications around the reservoir edge. Some of the specific concerns of the Ministry of Environment have been incorporated into the Commission's recommendations in Section 5.2 of this chapter respecting protection of wildlife. Ongoing discussion between the Ministries may identify more concerns. THE COMMISSION RECOMMENDS THAT THE MINISTRY

OF FORESTS CANVASS THE VIEWS OF THE MINISTRY OF ENVIRONMENT AND THE MINISTRY OF LANDS, PARKS AND HOUSING AND DESIGN AND ESTABLISH CLEARING STANDARDS THAT BEST SERVES THE GOALS OF FORESTRY, ENVIRONMENT AND RECREATION.

With respect to compensation, the Association of B.C. Professional Foresters, in its presentation, argued that intensive forestry and land management should be carried out at Hydro's expense to ensure that there is no net loss to the forestry resource in the region (100:16,405). One intervenor suggested that, during clearing, firewood should be stockpiled for use by provincial parks, or sold to the public (Ex164:10-11).

The Ministry of Forests indicated that in the past it has received stumpage on merchantable timber harvested for clearing, but no compensation for lost growing capacity of forest land. The Ministry did not argue for such compensation in the case of Site C.

The Commission concludes that the principle of compensation for Crown losses should be applied consistently for all resources affected by the project. So, even though the forestry resource loss is relatively small, it should be compensated for.

THE COMMISSION THEREFORE RECOMMENDS THAT HYDRO, AS A CONDITION OF THE ENERGY PROJECT CERTIFICATE, BE REQUIRED TO PAY COMPENSATION IN AN AMOUNT EQUAL TO THE PRESENT VALUE OF THE LOSS DUE TO FLOODING ($1.0 million) LESS THE STUMPAGE FROM CLEARING OPERATIONS. IN ADDITION, THE COMMISSION RECOMMENDS THAT, PRIOR TO THE ISSUANCE OF A CERTIFICATE, THE VALUE OF THE FORESTRY LOSSES RESULTING FROM CLEARING FOR THE TRANSMISSION LINES BE ESTABLISHED ON THE SAME BASIS AS THAT USED IN CALCULATING THE RESERVOIR LOSSES, AND THAT COMPENSATION BE PAID FOR THESE LOSSES AS WELL. THE COMMISSION RECOMMENDS THAT THESE PAYMENTS BE DIRECTED TO PROGRAMS MANAGED BY THE MINISTRY OF FORESTS THAT ARE AIMED AT ENHANCING FORESTRY ACTIVITY AND POTENTIAL IN THE REGION.

4.0 IMPACTS ON GENERAL OUTDOOR RECREATION

4.1 Hydro's Position

Hydro estimated the impact of the project on recreation in terms of the reduction in the number of user days. Based on a 1981 survey of recreational activity in the area during the months of June through September, Hydro's consultants estimated that currently there are approximately 14,000 user days[1] of recreation in the Peace River Valley (Ex 191). The relative importance of the different types of recreational activities is shown in Table 13.

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[1] An earlier recreation study commissioned in 1976 indicated much higher recreational activity. The results were based on personal interviews and a creel census carried out by the fisheries consultants and on a mail-back questionnaire. Because of widely divergent estimates from the different sources, the Commission considered the estimates from this study unreliable.

TABLE 13

BREAKDOWN OF GENERAL OUTDOOR RECREATION ACTIVITIES, 1981

Activity	User Days	%
Boating	1,304	9.4
Canoeing	1,052	7.6
Camping	6,552	47.1
Picnicking	2,076	14.9
Sightseeing	2,037	14.6
Walking/Hiking	171	1.2
Swimming	206	1.5
Gold Panning	82	0.6
Other	426	3.1
TOTAL	13,906	100.0

Source: Based on Ex 191: 16-22; excluding fishing and hunting

Hydro's consultants indicated that Site C would eliminate river-based recreational opportunities, including many attractive activities on the islands (camping, picnicking, viewing). Creation of the reservoir, on the other hand, would offer new types of opportunities more suitable to families and would provide greater access to the shoreline (Ex 202).

Hydro consultants reported that on completion of the project, although the water in the Valley would be visible from the highway for 35 km rather than the present 16 km, the visual diversity would be reduced so that the net change would be negative (Ex 202 : 59). Hydro consultants also indicated that the river crossing of the 500 kv line at the bridge on Highway 29 would have an adverse visual impact, as would the transmission line crossing Highway 29 south of the Peace River. The remainder of the 500 kv line from Site One to Site C generally would have a low impact on aesthetic values.

As shown in Table 14, Hydro's consultants estimated that by 1997 4,000 recreational user days would be lost due to the project. Applying estimated values per user day of reservoir-based and river-based recreational activity, the consultants calculated that the present value of the recreational resource loss would be $4.0 million at a 10% discount rate, $13.8 million at a 6% rate, and $51.6 million at a 3% rate (Ex 246 : Table 2).

TABLE 14

GENERAL RECREATIONAL USER DAYS

Year	Without the Project	With the Project
1982	14,900	14,900
1987	19,000	18,600
1992	23,900	20,900
1997	29,600	25,600

Source: Ex 243 : 6

With respect to impacts on tourism, Hydro's consultants argued that the importance of the Site C area will actually decrease over time, regardless of whether or not the dam is built. They also argued that the region would not experience any loss of tourism during the construction period, because tourists would divert their activities from the Peace River area to other sites within the region (Ex 104 : 8-11).

To compensate for the estimated recreational resource losses, Hydro proposed funding:

- a 50-unit campground with an adjacent 50-vehicle picnic site and boat launch ramp in the vicinity of Bear Flats:
- a boat launch ramp at the dam site;
- two small day-use facilities at Silver Spring Point and Lynx Creek
- various primitive camp sites accessible by water only on the south shore of the reservoir;
- a sum of $50,000 available to Hudson's Hope for parking, trails and other facilities in the Alwin Holland Park;
- a sum of $20,000 available to the local River Rats Club for the development of wilderness-type campsites on other rivers in the region (Ex 209).

Hydro estimated the capital cost of this program to be $2 million and the annual operating costs to be equivalent to a present value of $3 million. It stated that it should be given the responsibility for designing, constructing, and operating the recreation facilities except for Alwin Holland Park trails which should be Hudson's Hope's responsiblity and the wilderness campsites, which should be the River Rats Club's responsibility (58 : 9,439).

Hydro argued that the proposed compensation package meets two basic concerns. First, the proposed facilities generally reflect local desires. (Hydro pointed out that many of the components of the proposed package are similar to recommendations made by local intervenors.) Second, the compensation package is sufficiently comprehensive in scope and magnitude to offset the expected impact of the project. Hydro acknowledged that the District of Hudson's Hope would prefer to see the camping facilities split between Bear Flats and Lynx Creek, but was confident that a satisfactory mix of facilities within the proposed budget can be arranged in conjunction with Hudson's Hope, Fort St. John and the Regional District.

4.2 The Issues

4.2.1 Physical Impact Issues

The impact on general outdoor recreation is to replace one type of opportunity---river-based recreation---with another--- reservoir-based recreation. The magnitude of the loss depends not only on relative access, but on the relative quality of these two types of opportunities.

The Ministry of Lands, Parks and Housing testified that recreation safety would be reduced as a result of the reservoir because of debris on the water and a less stable shoreline. It also indicated that, despite assurances to the contrary, fluctuating water levels have consistently posed problems for reservoir recreation. Moreover, the Ministry feared that the length of open water would result in rough water conditions (Ex 208).

Other intervenors commented on problems related to usability of the shoreline and to water fluctuations. The loss of the Peace River for canoeing was cited as a major concern, not only of local, but of provincial significance.

The Commission concludes that the creation of the reservoir will provide recreational opportunities of a significantly lower quality than the ones that will be lost. The reservoir can serve as an important recreational resource in the region, but cannot adequately substitute for the river that will be lost.

The Ministry of Lands, Parks and Housing indicated that, in its view, Hydro's 1981 estimate of recreational activity in the area is probably low. However, it agreed with the methodology used and basically supported the results. Other intervenors indicated that the survey approach used by Hydro's consultants could have missed individuals who did not park or remain at the survey centres. One intervenor pointed out that the survey missed the month of May, which in 1981, because of favourable weather conditions, could have been the best month for camping. Hydro's consultant agreed that for a number of reasons, the 1981 estimate of user days is likely low (61:9,969-76).

The Commission concludes that, while Hydro's estimate of recreation activity is probably low, its methodology was sound and the results provide an acceptable basis for estimating impacts.

While the Ministry accepted Hydro's base (1981) level of general outdoor recreational activity, it assumed a quite different pattern of growth in the future. Whereas as Hydro's consultants assumed recreational user days would grow rapidly (at a rate of over 4% without the project), the Ministry assumed a growth rate of 1% per year. The Ministry assumed the same rate with and without the project, except for an eight year period beginning four years prior to the completion of the project to four years after the filling of the reservoir when recreational activity would be severely impeded.

The Commission concludes that the Ministry's projections of user days with and without the project are more realistic than Hydro's and has adopted them in evaluating the recreational resource loss.

4.2.2 Resource Valuation Issues

In calculating the value of the net recreational resource loss, Hydro's consultants assumed:

- a value of $29 per day for general recreational;
- a ratio of 1.2 to 1.0 for the value of river-based relative to reservoir-based recreation;
- a real increase in recreational values of 3% per year in the 'without project' case and 2% per year in the 'with project' case.

The Ministry, in calculating the net recreational loss, used quite different assumptions. For recreational values per day, the Ministry used $17.95 for Peace River residents and $16.60 for non-residents, much lower than Hydro's $29. And for the relative value of reservoir versus river-based recreation, the Ministry used a ratio of 1.5 to 1.0 instead of Hydro's 1.2 to 1.0.

As a result of these differences and differences in the estimated magnitude and timing of the impacts on recreational activity, the Ministry calculated a much lower value of the resource loss than Hydro. Its estimated a $3.7 million loss at a 6% discount rate, $2.4 million at an 8% rate and $1.8 million at a 10% rate.

The Commission concludes that both the Ministry's and Hydro's evaluation assumptions have some validity. Hydro's estimated recreational value of $29 per user day is better because it is a site specific estimate, based on a recent survey. The Ministry's estimates are based on surveys for the province as a whole. But the Ministry's estimates of the value of river-based activity relative to reservoir-based activity are more appropriate than Hydro's, given the type and quality of experiences each offers. Finally, the Commission *concludes that it is not appropriate to assume that the value of recreation will increase in real terms over time. The significance of future losses should be taken into account through appropriate discounting procedures, not by artificially escalating future values.*

On the basis of these assumptions and the Ministry's user day forecasts, the Commission has calculated that the net loss in general outdoor recreational activity will be $6.9 million using the hybrid procedure and $3.0 million using a 8% discount rate. This is the measure (in constant 1981 dollars) of the present value of foregone river-based recreation less the present value of the reservoir-based recreation created by the project. The present values have been calculated by discounting back to the assumed year of issuance of the Energy Project Certificate.

4.2.3 Mitigation and Compensation Issues

The Ministry of Lands, Parks and Housing proposed compensation measures quite different from Hydro's. They include 170 day-use and campground units at five major sites both off and on the reservoir. These facilities would not be built at once, but would be phased in as warranted by recreational demand (Ex 258B : 23-4). The Ministry estimated that they would be phased in from 1985 to 1994 (Ex 369 : 2).

The major off-reservoir sites were Peace Island Park, Clayhurst Ferry Landing and Peace River - Pine Nodes. The on-reservoir sites were Lynx Creek and Bear Flat. The present value of the capital and operating costs was estimated at $2.1 million using a 10% discount rate (Ex 370 : 2).

The major difference between the Ministry's and Hydro's proposals was the emphasis that the Ministry placed on the off-reservoir facilities, which it maintained would better offset the lost river-based opportunities. Hydro considered the program proposed by the Ministry to be a regional development plan, not a set of measures suitable for compensating losses due to Site C (112 : 18,317-9).

The Ministry also stated that, being the custodian of Crown lands, it will be responsible for the development of a land use plan if Site C is to proceed. It expects that the plan to take two years to complete after the decision is made. The Ministry argued that Hydro should pay some of the cost for developing the plan (90:14,658).

The Corporation of Hudson's Hope stated it would like to see a park developed east of Lynx Creek to compensate for the loss of recreational facilities at Hudson's Hope (Ex 256:11-4). The Regional District argued that the design of the compensation package should take into account the wishes of the local municipalities.

THE COMMISSION RECOMMENDS THAT AS A CONDITION OF THE ENERGY PROJECT CERTIFICATE, HYDRO BE REQUIRED TO PAY AN AMOUNT EQUAL TO THE PRESENT VALUE OF THE RECREATIONAL LOSS (WHICH THE COMMISSION HAS ESTIMATED AT $6.9 MILLION) AND THAT THESE FUNDS SHOULD BE USED TO DEVELOP PROGRAMS THAT WILL, IN PART, ENHANCE RECREATION BOTH ON THE RESERVOIR AND ON REMAINING RIVERS IN THE REGION. THE COMMISSION RECOMMENDS THAT THE MINISTRY DEVELOP SUCH A PROGRAM IN CONSULTATION WITH LOCAL AUTHORITIES; BUT THAT $50,000 BE EARMARKED FOR THE DEVELOPMENT OF ALWIN HOLLAND PARK BY HUDSON'S HOPE AND $20,000 BE EARMARKED FOR THE DEVELOPMENT OF WILDERNESS CAMPSITES BY THE RIVER RATS CLUB. THESE SUMS ARE TO BE TAKEN OUT OF THE TOTAL COMPENSATION TO THE MINISTRY OF LANDS, PARKS AND HOUSING. THE MINISTRY SHOULD ASSIST THE RIVER RATS CLUB BY IDENTIFYING AND NEGOTIATING LEASES FOR THE CAMPSITES. THE COMMISSION FURTHER RECOMMENDS THAT THE MINISTRY OR APPROPRIATELY DESIGNATED PUBLIC BODIES BE RESPONSIBLE FOR ALL NEW FACILITIES, INCLUDING THOSE ON THE RESERVOIR, WITH HYDRO GIVEN PUBLIC CREDIT FOR ITS FINANCIAL CONTRIBUTION.

In recognition of the importance of wildlife as a general recreational resource (over and above its specific importance for recreational and subsistence hunting), the Commission concludes that some of the compensation for general recreational losses should be directed to wildlife programs in the region, developed and administered by the Fish and Wildlife Branch. THE COMMISSION RECOMMENDS THAT $833,000 OF THE $6.9 MILLION COMPENSATION BE SO DIRECTED.[1] As discussed in the next section, this is the estimated non-consumptive, or general recreation wildlife loss which the Commission has estimated on the basis of the Ministry of Environment's submission.

5.0 IMPACTS ON WILDLIFE AND RECREATIONAL HUNTING

5.1 Hydro's Position

The Site C region---wildlife management units 7-32, 7-34, 7-35, is about 0.8% of the land area of B.C., but supports about 8% of the province's moose harvest, 7% of sharp-tailed grouse harvest, and 4% of black bear, wolf and ruffed grouse harvest (52:8,340-2). The area that would be affected by reservoir flooding provides critical winter habitat for moose, and for calving and fawning and rearing habitat for both moose and deer. This habitat is also of above average importance within the region for elk, coyote, grouse, Canada geese, bald eagles and possibly lynx and black bear (Ex 200:35-59).

The wildlife inventory carried out by Hydro's consultant assessed only the "standing crop", or present animal populations, of the study area. Although the consultant agreed that a biophysical mapping would suggest that higher wildlife populations could be supported, he argued that the standing crop approach is the correct measure of the project's impact since there are no specific plans for wildlife enhancement and no assured future demand for the increased stock (54:8,792-93). Based on the standing crop approach, the number of animals that could be lost to flooding is estimated as follows:

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(1) The $833,000 is approximately one-third of the recreational hunting loss which the Commission has estimated in section 6.2.

Moose	Deer	Elk	Bear	Grouse	Water Fowl
125-250	50-250	0-7	10-20	1500-3000	100-300

Sources: Ex 200:56-61; 56:8,980-85

Besides the direct flooding of the reservoir, the following project-related activities and factors would further affect wildlife: dam and transmission construction, highway relocation, bank sloughing and shoreline erosion, increased fog, windchill and hunting pressure. Hydro's consultant indicated that some of these impacts could account for additional habitat loss in the order of 10% of the flooding losses (Ex 200:63-65).

Impacts on non-game species, such as fur bearers, small mammals, aquatic birds, raptors, songbirds and reptiles, will also occur but no endangered species will be affected (53:8,557). A more accurate assessment of these impacts would require a two-to-three-year study.

Land loss and transmission line impacts on the three registered guide territories bordering the impact area were estimated at 0.8%, 1.1% and 2.6%. Increased access and hunting pressure could reduce the value of guiding services.

Nine traplines would be affected by the project, but losses will not involve more than 6% of the land area of any line. The trappers whose lines will be most affected estimated that the production capacity of their lines will decline by no more than 10% (Ex 200:71).

Hydro's wildlife consultant based his estimate of the potential loss of hunter days attributable to the project on his inventory of the standing crop. First, he estimated a harvestable surplus based on the populations of the standing crop; then he established the number of hunter days per kill by species using the Ministry of Environment's data; and finally, he obtained the total potential hunter days lost by multiplying the harvestable surplus by the hunter days per kill. The estimated loss ranged from 928 to 2,473 hunter days per year.

Hydro, however, did not use these values to calculate the recreational hunting loss. Using other means, Hydro's recreational consultant estimated the loss to be about 600 hunting days per year (61:9940-49). Based on this and an estimated value per hunter day of $32, escalating at a real rate of 2% per year, Hydro's consultant calculated that the present value of the recreational hunting loss would be $1.6 million at a 3% discount rate, $518,400 at a 6% discount rate and $181,400 at a 10% discount rate (Ex 254).

Regarding mitigation measures, Hydro indicated it would consider scheduling the clearing of specific reservoir areas as late as possible (through discussions with Ministry of Forestry) and leaving bald eagle nesting trees standing. Hydro indicated that clearing specifications would stipulate that habitat above the full supply level not be needlessly disturbed, and that areas affected during construction be rehabilitated (Ex 48).

Hydro's consultant recommended several mitigation measures for transmission lines including:

- leaving as much low vegetation as possible;
- clearing on the north side of the Peace by hand;
- no clearing from mid-May to mid-July;
- minimizing disturbance of drainage patterns;
- minimizing herbicide applications
- minimizing access road construction (Ex 194).

Regarding control of hunting, Hydro will require a no-shooting zone around its construction site (Ex 48).

With respect to compensation, Hydro proposed funding a wildlife management program at a present value cost of $0.7 million. Details of the program have not yet been worked out. Compensation for trappers was treated as a separate issue and was described in detail in Hydro's Registered Trapline Program (Ex 236). The nine affected registered traplines will be eligible for compensation under the program (Ex 209 : 3-4).

5.2 The Issues

5.2.1 Physical Impact Issues

The Commission heard a great deal of evidence from intervenors on the standing crop approach used by Hydro's consultant. The Ministry of Environment and other intervenors indicated that the Site C region has a special significance for wildlife management because of its unusually high capabilities (Ex 152A : A31). Furthermore, the Ministry testified that it did have a plan to increase the populations of moose, deer and elk in the region. The proposed population objectives for the year 2,000, based on realistic criteria, were 750 moose, 1,000 deer and 100 elk (Ex 152A : A26). The Ministry agreed that while netting out the costs of achieving these goals is analytically correct, management costs in the Peace Valley would be insignificant (103 : 16,948-9). Other intervenors also argued that a bio-physical capability approach is more appropriate for impact assessment than Hydro's approach (Ex 385; Ex 411A).

The Ministry accepted Hydro's estimate of standing crop for moose and deer (101 : 16,531) though both it and the Peace Valley Environmental Association expressed skepticism about the number of animals the consultant estimated he saw (101 : 16,615-8). The Ministry disagreed with Hydro's estimates of both wildlife and hunting-day losses. The Ministry testified that the moose herd will decline sharply in size and no longer produce any harvestable surplus for hunters. It estimated that lost reproductive habitat will result initially in the loss of 100-200 fawns annually, with the loss increasing as deer stocks build (Ex 152A : 31-3). Further, the Ministry and other intervenors argued that the regional loss of moose might be several times greater than that estimated by Hydro because Hydro's estimates were based on surveys done at a single point in time and did not take migration patterns into account (101 : 16,532-6).

The Ministry initially estimated that the annual loss of hunting days would vary from 50, five years prior to flooding, to 3,738 by the year 2000 (Ex 152A : 33). The Ministry said, and Hydro's wildlife consultant agreed, that demand has exceeded supply and will continue to do so for all species except grouse (102 : 16,830-2). Netting out grouse from its loss estimates (102 : 16,849) the Ministry estimated a loss of hunting days varying from a low of 50 prior to the project to 3,175 by the year 2000. These values are greater than Hydro's wildlife consultant's figures, and five times higher than the figures Hydro used to calculate recreational hunting resource loss.

In addition to these losses, the Ministry expressed serious concerns about the effects of transmission lines, highway relocation and dam construction (101 : 16,655-7; 16,664-5). Two intervenors suggested that increased fog may affect fur-bearing wildlife (Ex 289L ; 75 : 11,968); others suggested that, if Site C gives rise to access to the south shore, further wildlife losses will result due to disturbance, collisions with vehicles and competing land uses (102 : 16,832-5).

The Commission accepts the arguments put forward by the Ministry and some intervenors that Hydro's consultants underestimated the magnitude of the impacts on wildlife and recreational hunting. And it accepts the appropriateness of considering the lost enhancement potential. For purposes of evaluating the recreational hunting loss, the Commission has adopted the Ministry's estimates that recreational hunting will decline by 50 days just prior to the project and 3,175 days by the year 2000.

The Commission notes that the data on which these estimates were based is not entirely satisfactory. It was described by a Ministry representative as "inadequate, but the best available" (103:17,042-5). But the Commission believes the knowledge of the Ministry's local wildlife biologist and local residents is sufficient in this case to ensure a reasonable degree of reliability. However, it would have been preferable for Hydro and the Ministry, prior to the hearings, to develop a better data base and an acceptable methodology for estimating impacts. In Chapter XX, the Commission discusses and recommends such pre-hearing screening of the data for future Energy Project Certificate applications.

5.2.2 Wildlife Resource Valuation Issues

In calculating the value of the wildlife resource loss due to Site C, the Ministry of Environment not only used different (greater) impact estimates, but also different valuation assumptions. It assumed a recreational hunting value of $64 per day, based on a willingness-to-be-compensated as opposed to a willingness-to-pay approach. It included in its loss estimate a non-consumptive value, assumed to equal one-third of the recreational hunting value. And, finally, it included an indirect loss of $500,000 to take account of possible highway relocation and transmission line impacts, land use pressure from agriculture and forestry, and other effects. On the basis of these assumptions, the Ministry calculated a present value loss ranging from $2.0 million to $3.7 million, for discount rates of 10% to 6% as compared to Hydro's range of $181,400 to $518,400 for the same discount rates.

Hydro argued that non-consumptive use of wildlife is taken into account in its estimate of the general recreation loss and therefore it should not be counted here.

The Commission concludes that the value of the recreational hunting loss should be based on the willingness-to-pay not the willingness-to-be-compensated approach and, therefore, a value of $32 per day, as recommended by Hydro, should be used.

Applying this value to the Ministry's estimated loss of hunter-days (with grouse hunting netted out), the Commission concludes that the present value of the recreational hunting loss is $2.8 million using the hybrid procedure and $1.1 million using the 8% discount rate.

The Commission agrees with Hydro that non-consumptive use should not be added to these figures, since doing so would double count the general recreational loss. Allowance has already been made for this loss (estimated at one-third the value of the recreational hunting loss) in the allocation of general recreational compensation.

With respect to losses from sources other than flooding, particularly highway relocation and transmission line development, the Commission concludes that these should be dealt with in the monitoring program.

5.2.3 Mitigation and Compensation

The Ministry agreed with the mitigative measures suggested by Hydro's consultant , but made several additional recommendations:

1) camp garbage be incinerated or deeply buried within a fenced area;

2) access to roads on transmission line rights-of-way be restricted or controlled;

3) transmission line rights-of-way be managed to maximize browse;

4) appropriate animal control mechanisms be considered for the preferred highway alignment at the Halfway Rover;

5) special efforts be made to avoid damage to island riparian habitat east of the dam site.

The Ministry also stated it is common practice to ban firearms in camp and hoped Hydro would impose such a restriction (16,837).

BASED ON THE RECOMMENDATIONS MADE BY HYDRO'S WILDLIFE CONSULTANT AND THE MINISTRY OF ENVIRONMENT, THE COMMISSION RECOMMENDS THAT THE FOLLOWING MITIGATION MEASURES BE MADE CONDITIONS OF THE PROJECT:

- HABITAT ABOVE THE FULL SUPPLY LEVEL NOT BE NEEDLESSLY DISTURBED DURING CLEARING, AND PARTICULAR EFFORT BE MADE TO AVOID DAMAGE TO ISLAND RIPARIAN HABITAT DOWNSTREAM OF THE DAM SITE;
- A CLEARING SCHEDULE BE DEVELOPED IN CONSULTATION WITH FISH AND WILDLIFE OFFICIALS TO MINIMIZE WILDLIFE IMPACTS;
- TREES IN STRATEGIC LOCATIONS, AS IDENTIFIED BY FISH AND WILDLIFE OFFICIALS, BE LEFT FOR BALD EAGLE NESTING;
- HABITAT DISTURBED DURING CONSTRUCTION BE REHABILITATED TO ITS ORIGINAL STATE UNLESS OTHERWISE DICTATED BY THE GOVERNMENT'S LAND USE PLAN;
- CONSTRUCTION CAMP GARBAGE BE INCINERATED OR DISPOSED OF BY DEEP BURIAL WITHIN A FENCED AREA;
- FIREARMS BE BANNED IN CONSTRUCTION CAMPSITES;
- TRANSMISSION LINE CLEARING BE DONE BY HAND ON THE NORTH SIDE OF THE PEACE RIVER, NOT UNDERTAKEN BETWEEN MID-MAY AND MID-JULY, AND DISTURBANCE OF DRAINAGE PATTERNS MINIMIZED;
- TRANSMISSION LINE RIGHTS-OF-WAY BE MANAGED TO MAXIMIZE BROWSE WHERE NOT IN CONFLICT WITH AGRICULTURAL ACTIVITY OR OTHER USES UNDER THE GOVERNMENT'S LAND USE PLAN;
- FOR TRANSMISSION LINE MAINTENANCE, HERBICIDE APPLICATIONS BE MINIMIZED, AND SENSITIVE AREAS AS INDICATED BY THE MINISTRY OF ENVIRONMENT BE HAND CLEARED;
- CONSTRUCTION OF ACCESS ROADS BE MINIMIZED AND PUBLIC ACCESS RESTRICTED OR CONTROLLED.

The Ministry's compensation proposal included the following measures: (1) a biophysical analysis of crown and private lands in management units 34 and 35; (2) radio collaring of moose to determine their migration pattern; (3) acquisition of private land to increase the high capability habitat available for wildlife management; and (4) enhancement of habitats following the preparation of a comprehensive land use plan in and around the reservoir area. The Ministry also proposed that a surveillance and monitoring program be established and included as part of this program's personnel requirement in the compensation package (Ex 152A: A55; 103: 17,000-2). The present value of this program was estimated at $2.5 million at a 6% discount rate. In addition, the Ministry recommended a $1 million contingency fund be established (101: 16,524-5).

Other intervenors also presented views on various mitigation and compensation issues. One recommended that no sports hunting be allowed on the south shore (Ex 164; Ex 300). The B.C. Wildlife Federation urged that enhancement opportunities be pursued as a compensation measure (Ex 411). The North Peace Rod and Gun Club recommended that an area equivalent to that which would be flooded and with similar wildlife potential, be developed and managed. This enhancement program should aim to compensate in kind losses to the hunters, trappers, guides, native people, and users of outdoor recreation resources.

THE COMMISSION RECOMMENDS THAT, AS A CONDITION OF THE ENERGY PROJECT CERTIFICATE HYDRO BE REQUIRED TO PAY AN AMOUNT EQUAL TO THE PRESENT VALUE OF THE RECREATIONAL HUNTING LOSS, WHICH THE COMMISSION ESTIMATES AT $2.8 MILLION. THE COMMISSION ALSO RECOMMENDS THAT THESE FUNDS BE DIRECTED TO PROGRAMS IN THE REGION, DEVELOPED BY THE MINISTRY OF ENVIRONMENT IN CONSULTATION WITH LOCAL GROUPS, TO ENHANCE WILDLIFE PRODUCTIVITY.

6.0 IMPACTS ON FISHERIES RESOURCES

6.1 Hydro's Position

Hydro testified that the major impact of the Site C project on fisheries would arise from the present river system being changed into lake-type habitat. This would result in the loss of large areas of spawning habitat and in the reduction or elimination of fish species that are adapted only to flowing water conditions. Hydro's fishery consultant concluded that the species composition of the reservoir would be very different from its present composition. Rainbow trout numbers are expected to be low due in part to the effects of Site One; Arctic grayling and northern pike should increase; and mountain whitefish will occur in large numbers. Dolly Varden may show a slight increase initially but will decrease to a fairly low level later. Walleye will not likely become established without enhancement measures. Fairly large populations of suckers will develop (52:8,331-7; Ex 153:82).

In order to evaluate quantitatively the impact on fisheries, Hydro's consultant estimated the maximum sustainable yield of the river and the reservoir. The reservoir's maximum sustainable yield was estimated using Ryder's Morphoedaphic Index, which was, in turn, used in a regression equation, also developed by Ryder, to predict potential angling yield[1]. At an average of one fish per angling day, angling yield was estimated at a total of 14,000 angling days per year for the reservoir (Ex 153:41). The river's maximum sustainable yield was arbitrarily assumed to be lower than the reservoir's, and was estimated at 12,000 fish, and hence 12,000 angling days per year (Ex 235). The reservoir shows greater long-run productivity than the river because of increases in aquatic habitat and plankton populations (Ex 153:83; Ex 235).

However, Hydro did not use the above estimates to calculate the value of fishery losses. Based on 1981 survey results, angling days with and without the project were projected as follows, based on changes in population, participation and fishing attractiveness.

TABLE 15

B.C. HYDRO'S ESTIMATES OF ANGLING DAYS

	Without the Project	With the Project (1988 in-service date)
1982	4,100	4,100
1987	4,600	4,100
1992	4,800	6,200
1997	5,600	8,800

Source: Ex 243

On the basis of these activity levels and assuming a recreational fishing value of $27 per fishing day, increasing in real value at 4% per year without the project and 3% per year with the project, Hydro calculated a net loss of approximately $10 million at a 3% discount rate; $2.0 million at a 6% rate and $0.3 million at a 10% rate (Ex 246).

With respect to mitigation, Hydro indicated that its construction contracts will require that sediment loads be minimized through appropriate measures and that contractors follow all legal hunting and fishing regulations in the project area. The construction area will be monitored to ensure that all waste material is suitably handled (Ex 48).

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1 Ryder's Morphoedaphic Index and regression equation are defined in the Glossary. See also Ex 153.

Hydro's transmission line consultant recommended that uncleared forest buffer strips be left where the line parallels rivers, that access roads be kept to a minimum, that erosion be minimized through the use of vegetation or special techniques and that a sufficient number of well-designed culverts be used (Ex 194).

With respect to compensation, Hydro indicated it is prepared to fund a yellow walleye enhancement program at a cost of approximately $2 million (Ex 209:3).

6.2 The Issues

6.2.1 Physical Impact

The Ministry of Environment disagreed with Hydro's estimates of maximum sustainable yield and angling yield for both the river and the reservoir. The Ministry estimated that the river would support approximately 18,000 angling days per year, based on the impressions gained by its field officers over the years. It felt that Hydro's 1977 survey which indicated that 18,000 fish were harvested that year, corroborates that estimate. The Ministry argued that this yield is sustainable because the survey underestimated potential and actual harvest, and because Site One impacts on trout will not be as severe as Hydro predicted (101:16,698; 103:16,915-8).

The Ministry estimated that the reservoir's yield will be 75% of the river's yield, or 13,500 angling days per year. It predicted angling will decline because the strongly preferred sport species, rainbow trout, Arctic grayling and Dolly Varden, are predicted to decline by over 30%. The slight increase in overall fish productivity that the reservoir might experience will not offset this loss (Ex 152A:16,749).

Furthermore, the Ministry and other intervenors pointed out that the Morphoedaphic Index and Ryder's equation, used by Hydro to calculate yield, were not developed for use on river reservoirs and are poor predictors of yield in lakes with species composition similar to that expected in Site C (Ex 152A; 102:16,749).

The Ministry of Environment estimated angling days with and without the project as follows, based on its yield estimates, and assuming that demand has, or will shortly, exceed supply.

TABLE 16

THE MINISTRY OF ENVIRONMENT'S ESTIMATES OF ANGLING DAYS

	Without the Project	With the Project (1987 in-service date)
1977	11,400	11,400
1987	18,000	4,300
1988	18,000	8,000
1989	18,000	11,300
1990	18,000	14,300
1991	18,000	13,500
1992	18,000	13,500
1995	18,000	13,500
2000-2056	18,000	13,500

Source: Ex 152A

The Ministry claimed that Hydro's projections, based on its 1981 survey, underestimated fishing (102:16,744-7) and that they were calculated on the basis of outdated water quality data (61:9,873). Thus, whereas Hydro showed an increase in angling days as a result of the project, the Ministry showed a significant decline.

The Commission concludes that Hydro's estimate of maximum sustainable yield and angling days on the Peace River cannot be supported. It notes that Hydro's estimate of the existing river's capacity to produce fish and support angling was not based on any field work whatever, but was entirely theoretical. Respecting reservoirs, Hydro made no attempt to study past reservoirs it has created on the Peace River or elsewhere in British Columbia.

The Commission concludes that the Ministry's estimates cannot be relied upon either because they are not supported by hard data. The Commission therefore concludes that the fisheries impact estimates presented at the hearings must be considered unreliable; further study is required.

The Commission has carefully considered the nature of the study program which should be undertaken. The Commission concludes that the studies required to obtain definitive estimates of maximum sustainable yield for the Peace River are simply impractical. So, the Commission recommends that Hydro undertake the following projects instead.

First, since both the 1977 and 1981 results are flawed, Hydro should obtain a reliable estimate of angling days on the Peace River. ACCORDINGLY, THE COMMISSION RECOMMENDS THAT HYDRO CONDUCT A DETAILED ANGLING AND CREEL SURVEY RECOGNIZING THE CRITICISMS OF PREVIOUS SURVEYS REGARDING EARLY MORNING AND LATE EVENING FISHING, FISHING BY LOCAL RESIDENTS AWAY FROM PUBLIC ACCESS POINTS AND AT SITE ONE, AND WINTER FISHING.

SECOND, THE COMMISSION RECOMMENDS THAT HYDRO GATHER INFORMATION ON SPORT FISH MOVEMENTS IN THE PEACE RIVER AND TRIBUTARIES TO ASSIST IN DETERMINING THE IMPACTS OF FLOODING AND THE PROSPECTS FOR SURVIVAL OF EXISTING STOCKS. IN ADDITION, IT SHOULD INVESTIGATE SPORT FISH MIGRATION AND LIFE-HISTORY PATTERNS RELATED TO HABITAT ASSOCIATIONS TO ASSIST IN IDENTIFYING CRITICAL LIMITING FACTORS AND DESIGNING APPROPRIATE ENHANCEMENT MEASURES TO PROVIDE COMPENSATION IN KIND.

THIRD, THE COMMISSION RECOMMENDS THAT HYDRO, IN CONSULTATION WITH THE MINISTRY, CONDUCT STUDIES TO ASCERTAIN THE MOST EFFECTIVE MANNER IN WHICH SHORELINE AND TRIBUTARY ENHANCEMENT PROGRAMS MIGHT BE DEVELOPED FOR THE RESERVOIR. Shoreline investigations should identify potential spawning areas using existing maps and literature, and follow-up field studies should be conducted to determine suitability and feasibility of pre-impoundment enhancement methods.

The study programs outlined above incorporate much of the compensation package suggested by the Ministry. The Commission wishes to emphasize its conclusion that programs of this sort are not appropriate components of a compensation package but rather are the responsibility of the Applicant for purposes of determining compensation. THE COMMISSION THEREFORE RECOMMENDS THAT THE STUDIES BE SATISFACTORILY COMPLETED AS A CONDITION OF AN ENERGY PROJECT CERTIFICATE. THE COMMISSION ALSO RECOMMENDS THAT WHEN THE STUDIES ARE COMPLETED, APPROPRIATE COMPENSATION MEASURES BE DETERMINED IN THE MONITORING PROGRAM, USING THE EVALUATION PARAMETERS ADOPTED BY THE COMMISSION.

The Commission is also concerned about the lack of information on the productivity of reservoirs, particularly northern ones, already created by dam construction. The Commission considers it important that a body of knowledge be developed on the biological impact of the conversion of rivers to reservoirs. THE COMMISSION RECOMMENDS THAT THE APPROPRIATE GOVERNMENT AGENCY UNDERTAKE FORTHWITH THE STUDIES NEEDED TO PROVIDE THIS INFORMATION SO THAT THIS SIGNIFICANT INFORMATION GAP CAN BE CLOSED.

The Peace Valley Environmental Association presented evidence on mercury accumulation in the food chain resulting from reservoir flooding. The evidence strongly indicated that the creation of any reservoir in cool temperate North America is likely to result in predatory fish mercury levels in excess of the 0.5 ppm Canadian marketing standard (Ex 388A; 94:15,389). Peace Valley Environmental Association's consultant expected that this conclusion will apply to Site C as the extent of flooding and soils are typical of reservoirs exhibiting this phenomenon. The consultant did not expect, however, any effect on drinking water quality (94:15,441-2).

The Ministry of Environment recognizes that walleye are likely to bio-accumulate mercury. It will monitor fish mercury levels if Site C proceeds and would post warning signs around Site C if levels are found to be hazardous to health. Posting the fishery would significantly reduce the value of the fishery, though at this time the Ministry cannot say what the probability is that the fishery will be affected (102:16,881-94).

The Commission concludes that the matter of mercury levels in reservoir fish will become clearer if studies of what has happened in other reservoirs in the province are made as the Commission has recommended. In that way, by the time Site C is constructed, more information will be available to assist the Ministry in designing the appropriate enhancement program.

6.2.2 Resource Valuation Issues

On the basis of its angling day impact estimates and on the assumption that river fishing values are 1.2 to 1.5 times greater than the value of reservoir fishing, the Ministry calculated a net fishery loss of $2.0 million to $4.2 million for discount rates ranging from 10% to 6%. This compares to Hydro's estimate of approximately $0.3 million to $2.0 million over the same discount rate range.

The Commission concludes that the fishery resource loss cannot be estimated at this time because of inadeqate evidence on the magnitude of impacts. However, the Commission accepts that the evaluation parameters recommended by the Ministry, except for willingness-to-be-compensated, are appropriate for evaluation purposes. THE COMMISSION RECOMMENDS THAT THESE VALUATION PARAMETERS BE APPLIED UNDER THE MONITORING PROGRAM TO DETERMINE THE FISHERIES LOSS ONCE HYDRO HAS PROVIDED ACCEPTABLE INFORMATION ON IMPACTS ON ANGLING DAYS, AS RECOMMENDED IN THIS REPORT.

6.2.3 Compensation and Mitigation Issues

The Ministry proposed a compensation program consisting of four components: (1) pre-impoundment studies; (2) a walleye enhancement facility to be constructed after flooding; (3) post-impoundment assessment studies; (4) potential enhancement schemes. The estimated cost of the walleye program was $1.9 million discounted at 10%. A further $2 million of contingency funding was requested for potential enhancement schemes and to allow flexibility should measures preclude enhancement of walleye. In addition, the Ministry recommended that a pre- and post-construction monitoring program be carried out to Ministry standards, funded by Hydro, and that such a program be a requirement of the energy certificate (Ex 152A : A49-50).

The Ministry pointed out that minimizing erosion and sedimentation is a legal obligation under Section 33(2) of the Federal Fisheries Act. Several other intervenors recommended that Hydro compensate for losses by funding fishery enhancement facilities or programs (Ex 164; Ex 300; Ex 411A).

The Commission concludes that the precise amount of compensation for fisheries impacts cannot be made at this time since the magnitude of the loss has not been estimated. THE COMMISSION RECOMMENDS THAT WHEN THE LOSS IS ESTIMATED, HYDRO BE REQUIRED TO PAY THE GOVERNMENT AN AMOUNT EQUAL TO THE MAGNITUDE OF THE LOSS AND THE FUNDS BE USED TO ENHANCE FISHERIES IN THE REGION.

ALTHOUGH ADDITIONAL MITIGATION MEASURES MAY BE DEVELOPED DURING THE COURSE OF THE RECOMMENDED STUDIES, THE FOLLOWING CONDITIONS ARE TO BE IMPOSED.

- *SEDIMENT LOADS TO WATER BODIES DURING CONSTRUCTION BE MINIMIZED;*
- *WASTE MATERIAL BE SUITABLY HANDLED TO ENSURE PREVENTION OF WATER POLLUTION;*

ALONG TRANSMISSION LINES:

- *UNCLEARED FOREST BUFFER STRIPS BE LEFT WHERE THE LINE PARALLELS THE RIVER;*
- *VEGETATION CLEARING BE MINIMIZED;*
- *ACCESS ROADS BE MINIMIZED;*
- *ROAD CUTS AND STEEP GRADES BE STABILIZED TO MINIMIZE EROSION, USING SPECIAL TECHNIQUES WHERE NECESSARY;*
- *ADEQUATE CULVERTS BE PROVIDED.*

7.0 IMPACTS ON WATER QUALITY AND DOWNSTREAM USERS

7.1 Hydro's Position

The effects of the creation of the Site C reservoir on water quality were estimated by Hydro's consultant as follows:

- the reservoir will stratify only transiently;[1]
- water temperatures near Taylor will rise in July by 2.5-3.2°C;
- suspended sediments and turbidity will be reduced;
- nutrients, dissolved oxygen, total dissolved solids, hardness and iron will all remain similar to the present condition (52:8,350-8).

Hydro is aware that warmer water temperatures may affect downstream cooling and process water use at Taylor, where maximum river temperatures will reach 15-17°C. But Hydro held that these facilities were designed for pre-Williston conditions when water temperatures were higher and therefore the impacts would be minimal (Ex 239). On the positive side, warmer water in the summer could provide a better source of irrigation water, and the reduction in suspended sediments should be beneficial to downstream users (52:8,347-52).

Hydro stated that post-approval monitoring and data collection would be more detailed, that temperature monitoring is already underway and that Westcoast Transmission Company Limited data would provide an incentive to establish a baseline for relevant parameters (56:9,010-3).

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[1] Thermal stratification occurs in water bodies when they are quiescent. In warm weather the surface waters are the warmest while in winter the coldest water comes to the top where it freezes into an ice cover. In a headpond or reservoir such as the Site C forebay where there is an appreciable current the water will usually be mixed and the temperature the same from top to bottom. Stratification then will only be a transient phenomenon.

7.2 The Issues

7.2.1 Water Quality Impacts

The Ministry of Environment agreed with the results of Hydro's study of water quality except regarding the temperature increases, which it felt might be overstated since greater evaporation might offset the heat gain (Ex 152A : B-26).

Westcoast Transmission argued that a rise in water temperature of 2.5°C - 3.2°C would have serious consequences for the operation of its plant. The highest temperature recorded near Taylor is 17.8°C, and the highest average monthly temperature is 16.7°C (Ex 402; Ex 404). During cross-examination, it was made clear to the Commission that the facilities that were completed prior to the W.A.C. Bennett Dam were designed for intake water temperature of 15.6°C. Since then the plant has doubled its gas capacity and tripled its refinery capacity with its intake system unchanged. The expected impact may be even more severe since with Site C the Pine River water may reach the intake. Pine River water has greater scale-forming characteristics and is more turbid than the Peace (99 : 16,375-84).

The Commission concludes that Westcoast Transmission facilities might be affected but the exact nature and consequences cannot be identified at this time.

7.2.2 Mitigation and Compensation Issues

Westcoast Transmission argued that, if the problem caused by water temperature increases is serious enough, it would have to be remedied by one of the following alternatives: (1) installing a water refrigeration system; (2) installing a larger heat exchanger; (3) installing a larger cooling system. Each of these alternatives would require the expenditure of several million dollars (Ex 402 : 5). Westcoast Transmission, therefore, recommended that monitoring be carried out to collect the data needed to make a proper assessment of the impacts (99 : 16,379-80).

The Commission concludes that the identification of, and compensation for, impacts on Westcoast Transmission constitute a private matter, which Westcoast and Hydro should negotiate and resolve. HOWEVER, THE COMMISSION RECOMMENDS THAT, AS A CONDITION OF THE ENERGY PROJECT CERTIFICATE, HYDRO BE REQUIRED TO INSTITUTE A PROGRAM IN CONSULTATION WITH WESTCOAST IN ORDER TO IDENTIFY AND MEASURE IMPACTS.

Don Peck Holdings Ltd. indicated in a written submission that it holds a water licence authorizing the diversion of water from the Peace River upstream of Site C. This diversion is for irrigation and is authorized to be accomplished by means of a hydraulic ram. Don Peck Holdings Ltd. is concerned that, if the River is converted to a reservoir, the hydraulic ram will no longer be an effective means of obtaining irrigation water.

The Commission notes that Don Peck Holdings Ltd. did not call a witness to speak to the part of its submission dealing with its water licence, so neither the Commission nor other parties to the hearing had an opportunity to cross-examine on this issue. The submission does not explain what steps Don Peck Holdings Ltd. has taken to date to install facilities, whether the facilities would work, or what would have to be done if the river were converted to a reservoir. IN THESE CIRCUMSTANCES, THE COMMISSION RECOMMENDS THAT HYDRO NOT BE REQUIRED TO PAY COMPENSATION TO DON PECK HOLDINGS LTD.

8.0 IMPACTS ON HERITAGE RESOURCES

8.1 Hydro's Position

On the basis of a number of investigations of heritage sites beginning in 1974,[1] B.C. Hydro estimated that 135 to 150 known heritage sites could be adversely affected by the project. On the basis of both prior experience and sampling surveys, approximately one-third of these sites have been identified or located. By far the majority of artifacts identified are stone tools and flakes or chips resulting from stone tool manufacture. Sites dating back 11,000 years were found in the area (Ex 17 : 6-9). Remains of the Euro-Canadian occupation of the region, such as trade goods and the Rocky Mountain Fort and Rocky Mountain Portage House have also been recorded. Seventy percent of the known archaeological resources have been, or are subject to disturbance (Ex 207; Ex 208).

Hydro's consultant acknowledged that the heritage resources in the Peace River Valley are unique for their density and variety. However, Hydro maintained that an acceptable method of evaluating archaeological resources in dollar terms has not been developed (60 : 9,686).

Hydro argued that no further funding for mitigation or compensation should be undertaken unless the Heritage Conservation Branch can justify the expenditures in terms of the resulting benefits (Ex 209 : 8-9). The basis for this position was that about $600,000 has already been spent by Hydro on the most comprehensive heritage impact study by any developer in the province to date.

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[1] Hydro commissioned the first impact study of Peace Valley heritage resources in 1974 in the reach between W.A.C. Bennett Dam and the Alberta border. In 1976, two more investigations took place in the Site C area. In 1977 and 1978, an intensive investigation was conducted which sampled 12% of the project area with systematic excavation of eight sites. Results of the latest two years of investigation are reported in Exhibits 207 and 208.

8.2 The Issues

8.2.1 Physical Impact Issues

The Heritage Conservation Branch of the Ministry of Provincial Secretary and Government Services agreed that Hydro has undertaken the most comprehensive heritage impact study by any developer in the province to date (Ex 259: Section 1.1). In fact, of the heritage sites located, the most significant have been located by Hydro's consultant. These include those at Bear Flats, Farrell Creek, Site HBRH 17, just west of Cache Creek, and the two historic forts in the reservoir area. The Branch expressed concern about potential additional damage to, or losses of, heritage resources from post-construction development (Ex 259; 72: 11,586-9).

The Commission concludes that Hydro's impact study is sufficiently comprehensive to provide the necessary base data for assessing the potential loss of heritage resources.

8.2.2 Heritage Values

The Heritage Conservation Branch acknowledged that no acceptable method is currently available for evaluating the economic value of heritage resources, although the Branch is in the process of developing a willingness to pay study, which it hopes will provide the basis for such an evaluation (72: 11,571-2).

The Branch's position was that the heritage resources in the project area are unique and have scientific, public, historic, ethnic and economic significance (Exhibit 259: 7).

Several other intervenors also emphasized the significance of the heritage resources in the Peace River Valley. The Canadian Archaelogical Association referred to these resources as the irreplaceable records of 9,000 years of traditional cultures and the early European intrusion period and indicated that they are an important part of the province's history and identity (Ex 283; Ex 284).

The Commission recognizes that the heritage resources in the Peace Valley have unique scientific, historic and cultural values; it also recognizes the difficult and controversial issues involved in attempting to determine the economic value of these resources. The Commission concludes that the heritage resource value can only be determined by subjective judgement of the historical and intangible values of the resource.

8.2.3 Mitigation and Compensation Issues

Hydro's consultant recommended a ten year salvage excavation program. Its key elements include further survey, site assessment, historic and pre-historic site excavation or protection and the analysis and dissemination of the results of the program. The program would be designed to conform to the development phases of the Site C project and provides for sufficient time following construction to monitor the reservoir shoreline for previously unidentified resources and to complete the analysis of the previous years' studies. The total cost of the program was estimated to be between $1.9 million and $9.4 million ($1981). The wide range in the estimate is due to uncertainties concerning the real costs of data analysis, research and reporting (Ex 267).

Based on the consultant's recommendations, the Branch drew up a mitigation program, which it estimated would cost $4 million. Costs associated with the re-construction of Rocky Mountain Fort and Rocky Mountain Portage House have not yet been estimated (72 : 11,568). During cross-examination, the witness for the Branch indicated that it has an annual budget of $800,000, and if the Site C project were not to proceed, the Branch would likely not conduct excavation and studies in the Site C area (72:11,596-8).

Other intervenors, in pointing out the unique values of the Peace River Valley heritage resources, recommended that Hydro be responsible for completing the mitigation program as recommended by Hydro's consultant (Ex 284; Ex 283).

The Commission does not recommend that Hydro be required to compensate for the value of the heritage resources in the region, first, because it is impossible to measure this value and second, because the project does not preclude the immediate excavation of heritage sites prior to the construction of Site C.

The Commission has examined the proposed program and estimated that the effect of an immediate as opposed to protracted program would be to increase the present value of capital cost by $1.1 million using the hybrid procedure, $1.0 million using an 8% rate. In view of the fact that Hydro has already spent $600,000, the Commission concludes that Hydro should be responsible for only $0.5 million of this extra capital cost. The Commission further concludes that Hydro only be required to pay $0.5 million, if matched or exceeded by funds raised by the Branch through public subscriptions to implement the program.

THE COMMISSION THEREFORE RECOMMENDS AS A CONDITION OF THE ENERGY PROJECT CERTIFICATE THAT HYDRO MATCH FUNDS RAISED BY THE GOVERNMENT THROUGH PUBLIC SUBSCRIPTIONS FOR THE EXTRA CAPITAL COST OF A HERITAGE RESOURCE RECOVERY PROGRAM UP TO A MAXIMUM OF $0.5 MILLION DOLLARS.

9.0 IMPACTS ON TERRAIN AND MINERAL RESOURCES

9.1 Hydro's Position

Hydro in its Environmental Impact Statement (Ex 48) assessed the physical impacts of Site C on mineral, hydrocarbon and aggregate resources in the area. Coal is known to be present in the Gates Formation, occurring at depths of over 200 meters below the Peace River. Future mining would be unaffected by the reservoir since the Peace River presently covers the deposit.

The Wilder gas field is located near the Site C damsite but, except for the possible flooding of one well, it would be unaffected by the damsite. Future drilling would not be affected either. However an eight-inch gas line crossing the Peace River upstream from Site C could be affected by increased bank instability.

No oil resources are known in the area; the extraction of future discoveries would not be hindered by Site C even after flooding.

A survey of granular resources along the Peace River from the B.C.-Alberta border to Site One showed that large deposits in the area would not be flooded. The reservoir would cover numerous gravel bars, but this would represent only about 6% of the estimated total volume of sand and gravel (about 2.0 billion cubic meters) within the area.

Hydro argued that both coal and aggregates have no economic significance since their extraction is currently uneconomic because more accessible deposits are available. For these reasons, Hydro argued that neither prior recovery or compensation is required for coal or granular resources.

With respect to natural gas, Hydro has not estimated the costs of possible well flooding or pipeline disruption but is now considering detailed mitigation measures.

9.2 The Issues

Virtually no presentation were made by intervenors on physical impact, resource value or mitigation and compensation. However, there appears to be general agreement with Hydro's position. The Ministry of Lands, Parks and Housing acknowledged that the large gravel resources remaining above the reservoir full supply level will be more than sufficient for future demand.

The Commission concludes that the physical impact on terrain resources and associated economic losses resulting from Site C will be minor. The mining of the Gates Coal Formation is already uneconomic because of its location under the Peace River. Oil deposits are unknown in the area, and future exploitation would not likely be restricted in any case. Sand and gravel losses will occur, but they represent such a small proportion of total deposits in the area that foreseeable requirements could readily be met. The flooding of one gas well and stability problems for a proposed pipeline should be resolved by the parties involved.

The Commission concludes that no mitigation and compensation measures are warranted.

CHAPTER XV REGIONAL ECONOMIC AND SOCIAL IMPACTS

1.0 INTRODUCTION

The Site C project will have varying economic and social impacts on nearby towns, on rural residents and on the Indian communities in the region. These impacts will arise from two sources: the economic stimulus created by the construction of the project and the effects of reservoir flooding on physical and natural resources.

The economic stimulus will derive from construction of the dam, powerhouse facilities, transmission facilities, relocation of Highway 29 and reservoir clearing. These components of the project will require an estimated 5,400 man-years of work over a seven-year period (Ex 205:III). Not only will this activity directly affect employment and income in the region, but in addition it will induce indirect 'mulitiplier' effects because of local purchases of material, equipment and services, and local re-spending of workers' income.

The economic stimulus will also give rise to social impacts through the work force it will attract. The resulting population increase will have effects on housing needs and related water, sewage and other municipal infrastructure requirements; on school, hospital, police and other social services; and on the general quality of the life in the area.

The project's physical and natural resource effects will have specific regional economic and social consequences in addition to the resource loss implications discussed in Chapter XIV. An estimated 840 ha of land around the reservoir will be removed from residential use for public safety reasons, thus reducing municipal tax bases. This, together with possible increases in expenditures for additional infrastructure requirements, will have a direct impact on community finances. The flooding of ranching and homestead settlements on the north side of the Peace River will dislocate residents and disrupt their rural lifestyle. For native communities, the reservoir flooding will result in the loss of traditional hunting and trapping land. This, with the increased pressure on wildlife due to the project-induced increase in the local population, will adversely affect an important element of their economy and culture.

The communities and groups most directly affected by the regional economic and social impacts are as follows:

The City of Fort St. John - The population of Fort St. John was estimated at 17,000 in January 1980. Agriculture is the largest industry and has exhibited slow but steady growth. Forestry and oil and gas are the two other major industries (Ex 298:7). In terms of employment, transportation and communications are also significant contributors to the city's economy. The city is one of the focal points for air, rail and highway transportation from southern to northern Canada and Alaska. Significant quantities of raw or semi-processed products such as grain, lumber, veneer and petroleum products are shipped from the area on the B.C. Railway. The city's role in supplying material and equipment for northern industrial development has also been growing in importance (Ex 205:37-9).

The Village of Taylor - The population of the Village of Taylor is about 1,200. It is located on the Alaska Highway 15 km southeast of Fort St. John and is also on the Peace River, about 12 km downstream of the proposed Site C dam (Ex 351:1). Petro-Canada's refinery, Westcoast Transmission's gas and sulphur recovery plant and South Peace Wood Products' mill are located in the village. The Village of Taylor operates a municipal water and sewerage system to serve its own population (Ex 205:46 and 68).

The District of Hudson's Hope - The District of Hudson's Hope is located about 65 km west of Fort St. John on Highway 29. The population was estimated to be about 1400 in 1979 and at that time included construction workers employed on the Peace Canyon Dam. The present population is lower because many of these workers left when the project was completed. Settlement is largely concentrated on a bench on the north side of the Peace River although other small concentrations occur at Beryle Prairie and Lynx Creek. Lynx Creek will be flooded by the Site C project. The main settlement of Hudson's Hope has a small selection of local businesses. An ample supply of vacant land is available for expansion (Ex 205:47).

Rural Areas - The rural area surrounding Fort St. John is largely agricultural and is for the most part included in the Agricultural Land Reserve. The areas of extensive settlement are Charlie Lake, Grandhaven and Clairmont. None of these areas has municipal water supply or sewerage system. Charlie Lake, some 4 km northwest of Fort St. John, consists of about 450 residential dwellings.

The rural areas that will be most affected by the project are those along the north side of the Peace River stretching from the proposed dam site upstream to Lynx Creek. Most of the approximately 100 households consist of ranches and homesteads. No permanent residents live on the south side of the river, but the area is used for hunting and trapping (Ex 203:41-42).

Native Communities -The native Indian bands in the regions that will be affected by the project are the Blueberry, Halfway, Doig, Saulteau and West Moberly.

The Blueberry River Band is located about 57 km north of Fort St. John on the Blueberry River. There were 115 people on the band list in 1978. Hunting and trapping constitute the primary activities.

The Halfway River Band is located on the eastern bank of the Halfway River 30 km from its confluence with the Peace. There were 136 members in the band in 1978. A ranching operation was begun on the reserve in the early 1960's. The reserve is now a very successful Indian cattle ranch. The Halfway Band also has a vigorous hunting economy largely because of the local abundance of moose.

The reserve of the Doig River Band is located at the junction of the Doig and Osborn Rivers. There were 114 members in the band in 1978. Native students from this band attend high schools in Fort St. John despite the long travelling time involved. The band operates a ranch with between 80-90 cattle and 100 horses.

The Saulteau Band is located at the eastern end of Moberly Lake. Chetwynd, which is the local service, shopping and employment centre, is some 17 km away. There were 186 members in the band in 1978. In addition to hunting moose and deer, the band fishes in Moberly Lake and other smaller lakes and ponds in the area. Ducks and geese are hunted on the smaller lakes and ponds during migration in the fall and spring (Ex 374A: Chapters 5-8).

The West Moberly Band, which had 73 members in 1978, is located at the west end of the the lake and has an economy similar to the Saulteau.

This chapter presents the evidence and the Commission's conclusions on the nature and significance of the economic and social impacts that will be felt by these urban, rural and native communities as a result of the construction of the project and its physical and natural resource effects.

2.0 REGIONAL ECONOMIC IMPACTS

2.1 Hydro's Position

Hydro estimated that the manpower requirements directly associated with Site C construction, relocation of Highway 29, reservoir clearing and transmission line construction will total about 5,400 man-years, generating a gross income of some $206 million[1] over a seven-year period. During the peak year of construction, an estimated 2,000 workers will be employed. The part of this activity and income that will accrue to regional residents is estimated at 2,400 man years and $128 million over the life of the project. In the peak construction year, about 800 regional residents will be employed (63:10,123-128).

Project-induced expansion in the local service and support sectors is expected to create approximately 200 new jobs in the region during the peak year of construction due to multiplier effects. (Ex 205:144) Total income retained in the region after federal and provincial taxes, taking into account both the direct and multiplier-induced indirect jobs created by the project, is estimated to increase by $121 million over the construction period (63:10,123-5).

Hydro estimated that 55% of the total construction work force will come from outside the region. In the peak year of construction, approximately 1,230 non-resident workers will move into the area. Of this total, Hydro estimated that 1,000 workers would be living in camps located at the project site. The remaining 230 will be living with their families in the nearby areas, principally Fort St. John. As a result of this influx of workers and their families, as well as persons attracted by jobs created in other sectors of the economy, the population of Fort St. John is expected to increase by 870 during the peak year of construction (63:10,124-7).

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[1] All values in this chapter are in constant 1981 dollars.

The operation of Site C when construction is complete will have only a minor economic and population impact. The power plant will be operated by a staff of about 25. This will result in direct income of about $825,000 annually, and a population increase in Fort St. John of about 80 people.

Hydro submitted that, in view of current unemployment in northeast B.C., the employment and income generated by the construction of Site C will be socially beneficial, but indicated that this has not been explicitly reflected in its benefit-cost analysis.

Hydro noted that the general price level in Fort St. John would rise due to buoyant economic conditions during project construction except for accommodation, which is in surplus. This will result in a re-distribution of incomes in the region since certain segments of the local population such as those on fixed incomes and those dependent on various forms of social assistance and disability pensions, will experience a reduction in purchasing power.

2.2 The Issues

The following significant issues were addressed at the hearings with respect to the regional economic impact of the Site C project:

(a) The amount of employment accruing to residents as opposed to non-residents.

(b) The social benefit of Site C-related employment.

(c) The impact of reduced economic activity in the post-construction phase of Site C.

2.2.1 Resident vs. Non-resident Employment

An important factor governing the nature and significance of the regional economic impact is the number of jobs that will go to resident as compared to non-resident workers since this has a major bearing on the amount of income that will stay within the region. It also constitutes the primary assumption in projecting population growth and related social impacts.

The present agreement between Hydro and the Allied Hydro Council provides the following priority in hiring workers: (1) registered union members in the local areas; (2) registered union members from outside the area; (3) non-union workers from the local area; (4) non-union workers from elsewhere (Ex 209:10). Hydro estimated that 39% of the employment for the components of the project covered by the master agreement (the dam and site services) will go to regional residents. This estimate was made on the basis of information derived from three sources: discussions with union business agents in the region; the Peace Canyon employment file survey; and a cursory assessment of the regional construction labour supply and demand balance for 1980 (Ex 205:123).

With respect to the components of the project outside the master agreement, Hydro's consultant assumed that 100% of the reservoir clearing employment and 50% of the non-construction union employment for highway relocation and transmission line development will go to regional residents.

Overall, Hydro estimated that 45% of the Site C-related construction employment will go to regional residents. During cross-examination, Hydro's socio-economic consultants agreed that this estimate was primarily based on their polling of local business agents in 1977 and 1980 (67:10,985). They also agreed that this information is now out-dated because of the altered local economic situation and the increased time lag between the Peace Canyon project and the rescheduled Site C project.

In order to increase the employment benefits of Site C for regional residents, Hydro agreed in principle to participate in an affirmative employment program for Indians and to work with appropriate government agencies to encourage employment of local residents, hiring of local contractors and purchases from local suppliers. Hydro indicated, however, that the success of such initiatives relied entirely on the willingness of the unions to accept and encourage programs designed to assist and increase resident and native representation in local trade unions. Hydro indicated that such support was not provided at past projects.

The Commission recognizes that the percentage of jobs going to resident vs. non-resident workers essentially determines the regional share of employment benefits from the project as well as the magnitude of the project's adverse population-related social impacts.

The Commission concludes that Hydro's estimates of the share of the work that will go to residents are probably no longer reliable, since labour market conditions have changed so much since those estimates were made. The Commission believes, however, that more important and relevant than the reliability of certain study estimates, is the development of an agreement to encourage hiring of local residents and purchasing from local suppliers. Respecting local hiring in particular, such an agreement will have to be reached by Hydro, the Ministry of Labour and union representatives.

On the basis of the evidence at the hearing, the Commission concludes that Hydro alone currently supports programs designed to encourage local hiring. The Ministry of Labour is supportive in some circumstances but does not appear to perceive a need to improve on the experience of past Hydro projects. The unions appear to be resistant to the idea of increasing non union local hiring.

Based on the current status of the regional labour market in the northeast of the province, the Commission is convinced that local hiring, to a greater extent than was the case at Site One or the Bennett Dam, could well be the most significant contribution that can be made towards compensating the region for the adverse impacts of the construciton of Site C.

THE COMMISSION RECOMMENDS THAT HYDRO AND THE MINISTRY CONSULT WITH RELEVANT TRADE UNIONS TO FACILITATE INCREASED LOCAL MEMBERSHIP IN THOSE UNIONS AT LEAST FOR THE DURATION OF THE PROJECT.

If the construction of the project were to proceed under such labour market conditions as exist currently, the Commission would recommend that Hydro pay for and administer, in consultation with the appropriate unions, an aggressive program to train local residents and native people in the skills necessary to participate in the construction of Site C. The Commission recognizes, however, that labour market conditions may be very different when the project is built from what they are today. FOR THIS REASON, THE COMMISSION CANNOT NOW RECOMMEND THE INCLUSION OF A CONDITION IN AN ENERGY PROJECT CERTIFICATE REQUIRING THE TRAINING OF LOCAL PEOPLE. RATHER THE COMMISSION RECOMMENDS THAT THE NEED FOR SUCH A CONDITION BE DETERMINED IMMEDIATELY BEFORE AN ENERGY PROJECT CERTIFICATE IS ISSUED.

2.2.2 The Social Benefit of Site C Employment and Income

The magnitude of the social benefit of the employment created by Site C will depend on the extent to which jobs are created at a time of, and for occupations suffering from, unemployment. If persons hired for the project would otherwise be unemployed or underemployed, the social benefits will be considerable.

In 1980 when the Site C application was made, a number of large projects were scheduled for the same general time frame. It appeared that rather than hire persons who would otherwise be unemployed, the Site C project would in fact compete with other large employers for construction and trade labour. Under such conditions, there would be little regional social benefit from the Site C employment.

By the time of the hearings, however, those conditions had changed. Witnesses from the Ministry of Labour indicated that Site C would not create any construction manpower problem. Because of the cancellation and rescheduling of a number of major projects, no labour shortages were anticipated. Indeed, the project would provide welcome relief from depressed labour market conditions in the province.

The Commission concludes that under present economic conditions the employment created by Site C would be beneficial to the region and to the province as a whole. The Commission notes, however, that the extent of social benefits depends very much on the timing of the project. As economic conditions change, so will the magnitude of the social benefits from the project. THE COMMISSION RECOMMENDS THAT THE TIMING OF THE PROJECT NOT BE GOVERNED BY THIS FACTOR, BUT STRESSES ITS IMPORTANCE IN ASSESSING THE OVERALL BENEFITS OF THE PROJECT.

2.2.3 Post-Construction Impact of Site C

At the end of the Site C construction period, employment for the project itself and in businesses that have hired additional staff to cope with project-induced activity will decline sharply. Fort St. John residents expressed concern about the undesirable aspects of a short sharp increase in regional employment followed by a similar decrease, since it could aggravate the problems of what is already a highly cyclical economy. Concerns relating to post-construction impacts were cited with respect to the Revelstoke and Site One projects (Ex 331-2).

Hydro took the position that the post-construction decline in employment and population is the natural result of a large but temporary economic stimulus, and little can be done to mitigate it (Ex 205 : 189-91).

The Commission concludes that, analogous to the issue of the social-benefits of the employment opportunities created by the project, the magnitude of the impacts of the post-construction decline will depend on the extent of alternative employment opportunities available at the end of the project, both within and outside of the region. The Commission does not recommend that the project's timing be determined by this, but that it be considered in assessing the overall impacts and benefits of the project.

The Commission concurs with Hydro that few mitigative measures can be taken with respect to any significant post-construction decline other than advising the manpower and employment services as early as possible about the downturn in order to facilitate relocation and rehiring of the workers in other jobs.

3.0 INFRASTRUCTURE AND FINANCIAL IMPACTS ON LOCAL MUNICIPALITIES AND REGIONAL DISTRICT

3.1 Hydro's Position

Hydro stated that the population impact of Site C will be felt primarily in Fort St. John. An estimated 280 housing units will be needed there to accommodate project personnel and service sector workers during the peak construction years (63 : 10,128).

Additional tax revenue will accrue to the City of Fort St. John during project construction due to an enlarged taxable assessment and increased sales of municipally provided services, such as water and sewer. However, Hydro expects that incremental revenues will not fully offset the extra operating costs of providing services to an expanded population and forecast a shortfall in the general revenue and in the water and sewer utilities funds of approximately $150,800 over the construction period (63:10,125).

Hydro stated that it is prepared to pay $1.1 million toward the cost of developing a new water supply system in recognition of the negative financial impacts and the intangible social impacts caused by Site C. In addition, Hydro has budgeted $400,000 for any municipal administrative costs that can be identified as a charge to the project.

Hydro estimated that the influx of Site C construction personnel to the Village of Taylor will be small and hence population-related effects on municipal finances are likely to be minor (63:10,125).

Hydro did not accept the Village of Taylor's claim that Site C will cause problems at the municipal water intake and therefore accepts no responsibility for the additional engineering costs associated with its modification (116:18,874).

Hydro took the position that population and related impacts of Site C on Hudson's Hope finances will be negligible. However, based on prevailing property assessments and mill rates, the flooding of properties in the Lynx Creek subdivision could result in a loss of tax revenue to the district. Hydro agreed that the pump house, water intake and initial part of the distribution system of the water system will have to be replaced because of inundation and will negotiate with Hudson's Hope on details concerning costs and compensation (84:13,519-20). Hydro did not agree that there is any uncertainty about the security of the sewage treatment lagoons due to slope stability problems (63:10,125-8). However, it did agree that any problems that did develop because of the flooding would be its responsibility.

Hydro contended that no erosion would occur where the shoreline is bedrock (see Figure 5) and that flooding would slightly increase slope stability there (Ex 135). Hydro will construct a protective berm for the overburden bank through the residential area, monitor the slope regularly throughout the life of the project and compensate for any damage caused by bank instability (Ex 132 and Ex 135). It indicated that all other outstanding issues between the municipality and Hydro will be settled by negotiated agreements (116 : 18,877).

Hydro submitted that the construction of Site C will not likely have any significant fiscal impact on the Peace-Liard Regional District (Ex 205 : 185). Hydro contended that compensation to the district for project-induced costs should be settled by negotiated agreements (116 : 18,877).

3.2 The Issues

The major issues with respect to municipal infrastructure and financial impacts relate to the anticipated additional costs to be borne by local governments as a result of the population influx and reservoir flooding, Hydro's responsibilities in meeting these costs, and the role of negotiations in arriving at settlements.

3.2.1 Fort St. John

The City of Fort St. John generally supported the project subject to adequate compensation for project-induced infrastructure costs. The city stated that Hydro's offer of $400,000 will be sufficient to cover project-induced administrative costs and that Hydro's proposed $1,100,000 compensation package is adequate, (75 : 12,035). The city argued that Hydro should attempt to maximize local benefits from the project by, for example, providing recreational facilities on the reservoir. The council also requested that no project-related residential, commercial or industrial development be permitted outside the boundaries of Fort St. John. It felt that a monitoring program will be necessary to identify unpredictable impacts (Ex 198 : 10; 75 : 12,116-20).

The City felt very strongly that a public road access should be built across the dam to allow the development potential of the south shore to be realized and to shorten the distance from Fort St. John to Chetwynd (75 : 12,004-7). The city argued that such a road would not adversely affect traffic through Hudson's Hope because such traffic is presently largely concerned with recreation and tourism along Highway 29 (75 : 12,007). Hydro contended that the decision about a highway across the dam is not one for Hydro to make and in any case the costs should be borne by those requiring the road and not by Hydro's customers (112 : 18,257).

The Ministry of Highways indicated that it had not yet determined whether a new road between Chetwynd and Fort St. John is required and, if it is, whether it should cross the Peace River at Site C. The Ministry did indicate that, based on preliminary estimates, a new crossing of the Pine River might cost about the same.

The Commission concludes that the City of Fort St. John will face temporary revenue shortfalls as a result of increased administration costs and the provision of additional water and sewage services the city. However, the Commission concludes that the actual impact of Site C on municipal infrastructure and finances will depend in large part on the magnitude and patterns of in-migration into the area, which cannot be determined at this time.

THE COMMISSION THEREFORE RECOMMENDS THAT THE MATTER OF IMPACTS AND MITIGATION AND COMPENSATION FOR THE CITY OF FORT ST. JOHN BE REFERRED TO A MONITORING PROGRAM. Although the city is satisfied with Hydro's proposed compensation package, the Commission cannot endorse this package as a legitimate expense of the project since it is unclear that social impacts of such magnitude will in fact *occur. THE COMMISSION THEREFORE RECOMMENDS THAT THE NEGOTIATED AGREEMENT NOT BE MADE A CONDITION OF THE ENERGY PROJECT CERTIFICATE.*

With respect to the city's request for a road across the dam, the Commission concludes that this is a matter to be raised with, and resolved by, the Ministry of Highways. Construction of Site C merely provides an additional potential route for the highway should it be constructed. The dam does not itself lessen or increase the impacts or desirability of the highway. The Commission concludes therefore, that planning and costs in respect of such a road should neither be a responsibility of Hydro, nor a matter to be addressed in the Energy Project Certificate.

3.2.2 The Village of Taylor

The Village of Taylor testified that it had modified its water intake system in anticipation of Site C. It argued that it should be compensated $50,000 for this.

The Village of Taylor obtains its water from the Peace River. The system was built first in the late 1950's, and by the end of the 1970's, it was due for replacement. During the design stage of the infiltration gallery, which is located in the river, there was concern that construction of Site C could have adverse effects on the water supply. Therefore, when the new water intake system was built, it was set lower to take care of those anticipated problems (85:13,786-88).

During cross-examination, the Village's engineering consultant acknowledged that he did not contact Hydro with regard to the intake design. Moreover, he could not identify the source of the minimum flow data on which his design was based (85:13,804-9). It was further confirmed that the construction of Site One did not cause low flow problems for the Taylor water intake (85:13,822).

The Commission concludes that the changes in the design of Taylor's water intake were not necessitated by the anticipated construction of Site C. ***THE COMMISSION THEREFORE RECOMMENDS THAT HYDRO NOT BE REQUIRED TO PAY FOR INCREASED COSTS CLAIMED BY TAYLOR WITH RESPECT TO ITS NEW WATER INTAKE.***

3.2.3 The Corporation of the Municipal District of Hudson's Hope

River bank stability problems were cited as a major issue by Hudson's Hope and an association of riverside property owners. Two distinct geological conditions within Hudson's Hope had to be considered: the bedrock bank in the upstream of the community and the overburden banks further down (see Figure 5, p. 131). A consulting engineering firm hired by Hudson's Hope and the property owners examined both situations.

With respect to the bedrock river bank, the consultants disagreed with Hydro's contention that the rate of erosion of the bedrock slopes will be unchanged or improved by the reservoir. On the contrary, they maintained that the effect of the reservoir would be to accelerate the natural weathering or erosion process (85:13,707-708). It was recommended that (1) there be more detailed examinations of the bedrock strata be undertaken; (2) shotcreting [1] or similar protection of these zones be considered; (3) an ongoing monitoring program be instituted; (4) future drill holes should have their drill cores logged with piezometers sealed into specific strata for determining piezometric levels; (5) all future tests results and data collected be made available to the property owners for review (Ex 327:11-15).

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[1] Shotcreting is a process of placing concrete by blowing it onto a surface to fill cracks and to keep the surface from flaking and cracking.

With respect to the overburden slopes (Protection Zone A), another five recommendations were made, specifically that: (1) the berm, as described by Hydro, be constructed along the entire length of Protection Zone A; (2) construction take place prior to reservoir filling; (3) representatives of property owners be allowed to review construction progress; (4) detailed documentation of the existing state of overburden slopes followed by ongoing monitoring be carried out; and (5) additional piezometers be installed and sealed into specific strata between river and reservoir level (85:13,715-717).

Quite different issues with respect to impacts on Hudson's Hope are the loss of private land and related municipal tax base, and the loss of municipal properties and works from flooding in the Lynx Creek area. Hudson Hope submitted that it should be compensated by Hydro for these losses.

Hudson's Hope opposed the building of a road across the dam and contended that this would hurt it financially because tourists would be diverted away from the town (84:13,538).

With respect to the stability of the river banks formed by bedrock, the Commission accepts Hydro's contentions and its proposals for monitoring. The Commission concludes that the program recommended by the consultant for Hudson's Hope is not necessary at this time.

THE COMMISSION RECOMMENDS THAT A CONDITION OF THE WATER LICENCE BE THAT HYDRO CARRY OUT SUCH MONITORING OF BEDROCK BANKS AS MAY BE DIRECTED BY THE WATER COMPTROLLER. THE COMMISSION FURTHER RECOMMENDS THAT THE MONITORING REPORTS BE MADE PUBLIC AND THAT ANY CORRECTIVE ACTION REQUIRED BE CARRIED OUT BY HYDRO.

With respect to the stability of the overbunden banks, the Commission found substantial agreement between Hydro and the intervenors. The Commission accepts Hydro's design of the berm and proposals for monitoring.

THE COMMISSION RECOMMENDS THAT HYDRO COMPLETE THE DESIGN AS PROPOSED AND MONITOR THE OVERBURDEN BANK AREA IN HUDSON'S HOPE AS PART OF ITS SLOPE STABILITY MONITORING PROGRAM UNDER THE TERMS OF THE WATER LICENCE.

WITH REGARD TO THE FLOODING OF MUNICIPAL LAND AND PROPERTIES, THE COMMISSION RECOMMENDS THAT AS A CONDITION OF THE ENERGY PROJECT CERTIFICATE, HYDRO PROVIDE FINANCIAL COMPENSATION TO THE CORPORATION OF HUDSON'S HOPE IN AN AMOUNT EQUAL TO THE ESTIMATED NET DECLINE IN PROPERTY TAX REVENUE ATTRIBUTABLE TO LOST LAND[1] PLUS THE REPLACEMENT OR REPAIR COST OF MUNICIPAL WORKS, LAND AND FACILITIES THAT WILL BE LOST OR DAMAGED. THE COMMISSION RECOMMENDS THAT HYDRO AND THE CORPORATION OF HUDSON'S HOPE NEGOTIATE THIS AMOUNT AND IF AGREEMENT IS NOT REACHED PRIOR TO THE ISSUANCE OF AN ENERGY PROJECT CERTIFICATE, THE COMMISSION RECOMMENDS THAT IT BE REFERRED TO THE MONITORING PROGRAM FOR RESOLUTION.

3.2.4 The Peace-Liard Regional District

The Regional District, in its presentation to the Commission, raised the issue of its additional planning costs directly attributable to the Site C project. The district estimated the total cost impact would be $39,148 for 1982 and $26,400 for 1983 (Ex 350:8-12). In addition to compensation for these impacts, the district also requested that other non-quantifiable costs be assessed by the monitoring program (84:13,648).

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[1] In calculating this amount, increased tax revenues due to relocation should be taken into account: "... to the extent that any residents will locate elsewhere in Hudson's Hope there would be no loss in net terms as taxes would be collected from the resettlement properties" (Ex 330:Sec. 2, p. 4).

During cross-examination, witnesses for the district acknowledged that a financial contribution will be made to the district through a levy on the camp and buildings used for the Site C project (84:13,665). They also found it difficult to identify items that could be described as intangible impacts.

The Commission concludes that, although the Peace-Liard Regional District will incur additional planning costs directly as a result of Site C, it may receive revenues from a levy on project construction facilities. THE COMMISSION RECOMMENDS THAT ANY REMAINING SHORTFALL IN REGIONAL DISTRICT REVENUES BE DEALT WITH BY THE MONITORING PROGRAM. THE COMMISSION ALSO RECOMMENDS THAT HYDRO BE RESPONSIBLE ONLY FOR THE NET COST TO THE DISTRICT AND NOT BE REQUIRED TO PAY COMPENSATION FOR UNDEFINED, INTANGIBLE IMPACTS.

4.0 SOCIAL SERVICE IMPACTS

4.1 Hydro's Position

Hydro estimated that by 1985, the peak year of project construction and employment, the project-induced population growth in the Fort St. John area will create the need for one to two additional ambulance attendants, two doctors, seven hospital beds, one dentist, one public health nurse, one clerk at the Ministry of Human Resources. One part-time social worker, about nine teachers and seven classrooms, and at least one more probation officer will be needed, depending on the number of transients. In effect, the Site C project will require Fort St. John to provide services to meet the needs of a larger population about four years earlier than would be expected without the project. Hydro noted that there is presently a shortage of medical doctors and that this problem will become more acute with Site C (63:10,107-10).

Hydro argued that many social service costs associated with Site C that are a provincial government responsibility, such as health services, would be incurred by the province regardless of where workers and their families would be living. Hydro therefore concluded that these costs cannot be considered the direct result of Site C.

4.2 The Issues

The major issues with respect to social service impacts relate to the magnitude of the impact, the extent to which Site C would be responsible, the measures that should be undertaken, and who should undertake them.

4.2.1 Health and Hospital Service Impacts

The Fort St. John Hospital presented evidence on anticipated hospital and health service issues in relation to Site C. The Fort St. John Hospital has 100 in-patient beds. At the present time 15 beds have been taken out of service. The Hospital expressed concern about (1) the 15 beds presently out of service being needed as a result of the project, (2) the general lack of funds for hospital services; and (3) possible future operating deficits attributable to Site C; and (4) the difficulty of recruiting medical doctors. It recommended that the monitoring program identify and respond to future project-induced impacts on hospital services.

The Commission concludes that while it is impossible to predict, in advance, the extent of the impacts on health and hospital services that will be caused by Site C, the project will clearly have impacts on these services. While the Commission notes that the provision of health and hospital services is a responsibility of the provincial government and hospital districts, the Commission concludes that Hydro should be responsible for the costs attributable to the project.

THE COMMISSION RECOMMENDS THAT THE EXTENT OF HYDRO'S RESPONSIBILITY FOR HEALTH AND HOSPITAL SERVICE COSTS BE DETERMINED BY THE MONITORING PROGRAM. THE COMMISSION FURTHER RECOMMENDS THAT HYDRO'S RESPONSIBILITY IN THE MATTER BE CAREFULLY LIMITED TO REIMBURSEMENT FOR THE EXTRA HEALTH AND HOSPITAL SERVICES REQUIRED AS A RESULT OF SITE C.

4.2.1 Other Social Service Impacts

Little specific evidence was presented on other social service impacts, such as human resources and education, except for Hydro's impact estimates. Intervenors were generally concerned that those impacts be monitored and dealt with.

THE COMMISSION RECOMMENDS THAT THE ASSESSMENT OF OTHER SOCIAL SERVICE IMPACTS BE REFERRED TO THE MONITORING PROGRAM. WHEN AND IF SUCH IMPACTS CAN BE IDENTIFIED AND HYDRO'S SHARE OF RESPONSIBILITY DETERMINED, APPROPRIATE MITIGATION OR COMPENSATION MEASURES SHOULD BE TAKEN AT HYDRO'S EXPENSE.

5.0 SOCIAL IMPACTS ON THE RURAL COMMUNITY

The rural communities of Charlie Lake, Grandhaven and Clairmont might experience some social impacts.

The Site C project will more directly affect the approximately 100 households in the Peace River Valley from the dam site to Hudson's Hope. About 17 families whose houses are inside the safeline, will have to leave their homes. For the others, either part or all of their land will be flooded, and they will have to make major accommodations. Indeed, the viability of their continuing in the same locations may be doubtful and will have to be determined on a case-by-case basis.

The Commission heard a good deal of evidence on these impacts, including the loss of homes and enforced changes in lifestyle, and believes that such disruption constitute the most significant direct social impact of the project.

The social impact began in 1956 when the flood reserve was put on the valley from the Alberta border upstream to the head of Williston Lake. Insofar as the Site C reservoir is concerned, concerns were greatly intensified when actual investigations began in the early 1970's. These concerns were not limited to those living in the Site C area, but included those in the Site E area. It was apparent from evidence given at the hearings that some intervenors were unsettled by Hydro's Board of Directors' continuing unwillingness to relinquish the flood reserve on lands below the Site C area.

The Commission concludes that the prospect of the construction of the Site C project has already had a disrupting social effect on the people living in the part of the Peace River Valley that would be flooded. The Commission further concludes that the retention of the flood reserve on the lands below Site C continues to be disruptive and an obstacle to agricultural development.

The Commission recognizes that the disruptive social impacts in the Site C reservoir are inevitable and cannot be mitigated to any significant degree. The people affected must be compensated for their losses. The Commission concludes that this can only be done by Hydro in negotiating with each person or family affected.

BECAUSE OF THE CONTINUING DISRUPTIVE EFFECT OF THE FLOOD RESERVE, THE COMMISSION HAS RECOMMENDED IN CHAPTER IX AND XIV THAT THE FLOOD RESERVE ON THE PEACE RIVER VALLEY FROM THE ALBERTA BORDER TO SITE C BE REMOVED.

5.1 B.C. Hydro's Land Acquisition Program for Site C

At the request of the Commission, Hydro submitted documents and files relevant to its land acquisition program for Site C (Ex 287).

The Site C land acquisition program dates back to 1971 when Hydro's general manager requested the land department to estimate the cost of acquiring land between the proposed Site One dam and the Alberta border. In 1975, social consultants for Hydro held meetings with local residents, offering information on Sites C and E. In the following year, Hydro began to ask property owners permission to enter their properties for drilling and exploratory work.

At this time, Hydro had become aware of the unfortunate, unfavourable publicity that these activities had generated in the local communities due to misunderstanding and confusion. A public meeting was held in Fort St. John attended by representatives of Hydro management. Subsequent to this meeting, Hydro management approved, in principle, a general offer to purchase at fair market value all private lands below the safeline, with an offer to lease back the land to each rancher or farmer at an annual rent of about 3% of the sale price.

In 1977, several property owners approached Hydro's Property Division with a request to be bought out. It was proposed that in addition to the lease-back arrangement, sellers be offered a right of first refusal to buy back the property at the original purchase price if the project were abandoned. Hydro's management approved these proposals. Unfortunately, Hydro's willingness to include this buy-back provision was not made known to all property owners until 1980 when Hydro's final land acquisition policy was made public. That policy was in turn withdrawn after the Utilities Commission Act was proclaimed, pending the issuance of an Energy Project Certificate for Site C.

5.2 The Issues

The timing of Hydro's land acquisition program as well as the terms they included were sources of major concern to many local residents, particularly those whose lands were directly at issue. The terms of reference do not allow the Commission to dictate either the timing of acquisitions or the amount of compensation to private land owners in the area. Both are matters for private resolution between Hydro and affected parties. Hydro frankly acknowledged that the system employed at Site C was not a success and created unnecessary apprehension in the community.

The Commission concludes that the most important attributes of any acquisition program is consistency and urges Hydro to make every effort to be fair in the way it acquires additional land if Site C goes ahead and in the way it disposes of land not ultimately required for the project.

6.0 SOCIAL AND ECONOMIC IMPACTS ON NATIVE COMMUNITIES

6.1 Hydro's Position

Hydro's social consultant identified the Blueberry, Doig, Halfway, Saulteau and West Moberly bands as the native communities most likely to be affected by the project. In 1978, their total population was 624. The consultant testified that there is a strong subsistence economy in the area, based largely on hunting and trapping activities, and that the native people are generally concerned about development in the region because of loss of wildlife habitat, increasing pressure on the wildlife resource from recreational hunters, and the social and community problems that arise from major development projects. The consultant concluded that the Site C project will not create new social problems for the Indians, but will exacerbate existing ones (Ex 203).

Hydro's general position was that while it recognizes the concerns of the native people, these concerns largely relate to matters beyond the scope of Site C, and that the impact of Site C in itself will be small. Hydro indicated that, in its view, the specific recommendations of the Treaty 8 Tribal Association to the Commission to protect their lifestyle are beyond its responsibility and outside the scope of these hearings (116:18,948).

6.2 The Issues

Three basic issues were raised by the Treaty 8 Tribal Association on behalf of the Indian bands that could be affected by the project. The first was the survival of the native subsistence economy in light of Site C and other development projects in the region. The problem is not simply one of assessing the impacts of Site C, but whether and how one should assess these impacts in the context of the cumulative effects of all development projects on Indian people. The second was the substance and status of Treaty 8, and the protection it affords to native hunting and trapping rights. The third concerned the proposed mitigation and compensation measures, including matters related to the protection of wildlife.

6.2.1 Survival of the Native Subsistence Economy and Role of Site C

Witnesses for the Treaty 8 Tribal Association testified that there is a strong traditional economy based on hunting and trapping. The major wildlife species hunted by the Indians is moose. An estimated one pound of meat per person a day is consumed (90:14,732-3). The witnesses argued that this traditional subsistence economy is currently under a great deal of pressure as a result of development projects in northeastern B.C. Increased recreational hunting pressure was cited as the greatest threat to the Indians resource base. It was argued that, despite the flexibility of native hunting, the present situation is grave and the survival of the subsistence economy is in doubt.

Three types of impacts that could affect native hunting were identified (91:14,925-36). First, the flooding of the reservoir will result in the loss of some wildlife habitat. Second, the valley will be lost as a wintering and calving range for moose. Third, recreational hunters may move further into Indian hunting territories when they are displaced from the Site C area. This would be aggravated if there were a road across the dam, since that would give recreational hunters additional access to Indian hunting territories on the south side of the Peace River.

Witnesses for the Tribal Association testified that the real significance of these impacts can be appreciated only when the impacts of Site C are considered in the context of all the accumulated impacts on the native subsistence economy and their way of life. It is only from this point of view that the Indian's concerns can be properly understood (91:14,914-6).

The Commission concludes that the historical conflict between the Indian subsistence economy and the development plans for the provincial economy is not within the Commission's terms of reference. The Commission's responsibilities are to assess the impacts of the Site C project.

The Commission concludes that while the impacts of Site C will be relatively small on a provincial scale, they will be significant to the native population of the region. THE COMMISSION RECOMMENDS THAT THE SOCIAL IMPACTS OF SITE C AS WELL AS THE IMPACTS ON NATIVE HUNTING, TRAPPING AND FISHING ACTIVITIES BE DEALT WITH BY THE MONITORING PROGRAM.

The Commission concludes that the question of the cumulative impacts of development projects on the native economy should not be addressed by a Site C monitoring program or by any specific conditions in the Energy Project Certificate. Nevertheless, while the Commission does not believe Site C should be used as a focal point for general native concerns, THE COMMISSION RECOMMENDS THAT THE EVIDENCE SUBMITTED BY THE TREATY 8 TRIBAL ASSOCIATION BE CAREFULLY REVIEWED AND CONSIDERED BY THE APPROPRIATE FEDERAL AND PROVINCIAL MINISTRIES. The Commission concludes that consideration of the role of native groups in the protection and management of wildlife resources in the region is vitally important to the native people.

6.2.2 Role and Status of Treaty 8

The Treaty 8 Tribal Association presented a panel of witnesses that addressed the issue of the legal status of Treaty 8. They argued that the Indian people understood the signing of the treaty to have provided protection for their hunting and trapping, and fishing and gathering rights (91:14,854). The testimony of a number of witnesses indicated that the text of the treaty does not reflect the understanding that many of today's Indian people obtained from their forefathers through oral tradition. The Indian people today are not rejecting the treaty itself, although they certainly reject it in terms of what is written in the text (91:14,860-9). They maintain that the treaty should be read to embody the protection their forefathers thought they had obtained when the Treaty was signed. In a separate presentation, the United Native Nations, suggested that the land title and treaty status should be settled before any new development is allowed to proceed (100:16,429-46; Ex 406).

The Commission concludes that it is not the appropriate body to interpret the true meaning of Treaty 8; that issue must be resolved in other forums. The meaning of Treaty 8 is of significance not just to energy projects but also to all competing uses of land in areas of the province covered by Treaty 8. This Commission clearly is not in a position to resolve such a broad issue and is not required to do so by its terms of reference.

Treaty 8 recognizes that the Indian people had a unique relationship to the land. The Commission concludes that because of this relationship, Indians should be compensated for adverse impacts arising from alternate land uses. Since they once enjoyed exclusive use of the land, the Commission further concludes that such compensation should be based on a willingness-to-be-compensated basis and not willingness-to-pay.[1] *With respect to wildlife impacts, this suggests to the Commission that for native people, wildlife losses must be compensated in kind; monetary payments alone will not suffice.*

6.2.3 Mitigation and Compensation

The Tribal Association recommended a number of mitigation and compensation measures. To mitigate the impact of increased recreational hunting pressure, it recommended that vehicles should be prohibited from crossing the dam and gaining additional access to the hunting territories south of the Peace River. It also recommended that the government place severe restrictions on recreational hunting in the heartlands of the Indian hunting territories.

The Association also recommended that Indian people be given the opportunity to participate actively in the management of the wildlife resources in the Treaty 8 area of northeastern B.C.

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[1] See pp. 147-8 for further discussion.

Finally, the native witnesses urged that mitigation and compensation programs and monitoring activities should be designed and implemented by the native communities themselves.

The Commission concludes that the native people should be compensated adequately where impacts can be identified. With respect to adequate compensation, two matters need to be clarified.

First, with respect to the project's potential impacts on the Indians' hunting economy, measures should be taken so that the Native Indians are compensated in kind. The Commission believes this can be achieved through the Fish and Wildlife Branch of the Ministry of Environment. The regional wildlife biologist of the Branch testified that the natives' take of wildlife has been taken into account in regional wildlife management. The method used and the results obtained were compatible with the data supplied by the Treaty 8 Tribal Association's witness. IN ORDER TO MAKE SURE THAT THE INDIANS ARE COMPENSATED IN KIND, THE COMMISSION RECOMMENDS THAT THE COMPENSATION PACKAGE FOR WILDLIFE IMPACTS BE DETERMINED BY THE FISH AND WILDLIFE BRANCH AFTER CONSULTATION WITH THE NATIVE PEOPLE AND THAT THE PACKAGE PROVIDE FOR THE INDIAN'S CONSUMPTIVE USE OF WILDLIFE. Matters relating to recreational hunting restrictions must be raised directly with provincial government officials. The issuance of an Energy Project Certificate for Site C should not be tied to such restrictions.

Second, the Commission is not persuaded that there are likely to be any social impacts of Site C that would justify direct monetary compensation to Indians in the region. Their own testimony clearly suggests that mitigation programs designed to reduce impacts are far more useful than monetary compensation payments after the impacts have been experienced. ACCORDINGLY, THE COMMISSION RECOMMENDS THAT HYDRO OR THE MINISTRIES NOT BE REQUIRED TO MAKE ANY DIRECT PAYMENTS TO THE NATIVE PEOPLE.

The Commission tried without success to obtain specifics from the native people regarding the nature and magnitude of potential social impacts. The Commission concludes that it is not possible to determine these impacts in advance.

THE COMMISSION RECOMMENDS THAT THE INDIANS REPORT IMPACTS TO THE MONITORING PROGRAM AND SUGGEST REMEDIAL MEASURES. THIS IS IN ACCORDANCE WITH THE NATIVE PEOPLE'S EXPRESSED DESIRE TO BE ALLOWED TO DEVELOP THEIR OWN MITIGATION AND COMPENSATION MEASURES. THE COMMISSION FURTHER RECOMMENDS THAT HYDRO BE DIRECTED TO PROVIDE FUNDS FOR THESE MEASURES TO THE EXTENT THEY ARE APPROVED BY THE MONITORING AUTHORITY.

CHAPTER XVI MONITORING PROGRAM

1.0 INTRODUCTION

A monitoring program for the Site C project was recommended by Hydro and intervenors. The Commission concurs with this proposal. In Chapters XIV and XV, the Commission recommended that a number of matters be referred to such a program. In this chapter, recommendations are made regarding the scope, structure and responsibilities of a monitoring program.

While many intervenors spoke about the role and importance of monitoring, only two provided comprehensive recommendations for a monitoring program. The Professional Development Advisory Committee, a group representing several social service agencies in Fort St. John, presented its proposals for a monitoring program. This group's study on monitoring was funded and endorsed by Hydro. A panel of experts called on behalf of Hudson's Hope, Taylor, Dawson Creek and the Regional District presented its analysis of how a monitoring and impact management program could best be structured.

2.0 HYDRO'S POSITION

Hydro recommended that a socio-economic impact monitoring program be established in the City of Fort St. John and proposed that the details of the program be developed in consultation with the city along the lines recommended by the Professional Development Advisory Committee (PDAC) in Exhibit 308. Hydro pointed out that the city and PDAC proposals are basically in agreement.

The objectives of the monitoring program outlined in the PDAC submission include assessment of the community's needs, measurement and identification of actual impact, impact management, provision of information to the community, and verification of compliance with mitigation measures.

The monitoring structure proposed by the PDAC would consist of a three-person staff, a monitoring committee representing local services and communities, as well as Hydro, and an impact management board consisting of senior representatives of the City of Fort St. John, provincial government agencies, Hydro and the monitoring committee. The staff would report to the monitoring committee, who would be responsible for directing the program, including deciding on mitigation measures within specific expenditure limits. The impact management board would meet to resolve disagreements referred to it by the committee and would verify compliance with agreed-upon mitigation measures. PDAC recommended an arbitration board be set up, consisting of one to three top level Cabinet appointees or members of the Utilities Commission, who would have authority to issue binding orders to Hydro and provincial ministries.

3.0 SUMMARY OF ISSUES

Establishing an effective monitoring program requires the resolution of the following matters:

- purpose of monitoring;
- scope of program;
- structure and responsibilities; and
- funding.

3.1 Purpose of Monitoring

Hydro and intervenors identified a variety of objectives for a monitoring program. They generally agreed that it should try to resolve or mitigate impacts and investigate grievances, but they did not always identify the precise purpose of monitoring.

The Commission believes that for a monitoring program to be successful, the rationale for monitoring and the purposes it can serve must be clearly specified. First, a mechanism or process is required to deal with project impacts that have not been resolved by specific terms and conditions of the Energy Project Certificate because they can be more appropriately dealt with as they arise during the course of the project. Monitoring, in this case, serves as an alternative to resolving impacts before the certificate is issued. It is a necessary or preferred alternative when (1) the nature of the impact is inherently uncertain and can only be assessed as the project is undertaken, or (2) the impact can, in principle, be assessed, but the data is insufficient to derive reasonable and well-informed conclusions on its nature and magnitude and, deferral is prudent because the costs of advance assessment would be large relative to the general magnitude and significance of the impacts, or (3) unanticipated impacts might arise that will be capable of resolution once they are identified.

Second, a process is required to verify compliance with conditions specified in the Energy Project Certificate. Compliance can only be ascertained when the conditions are implemented.

The Commission has recommended in Chapter XIV that an additional function of the monitoring program be to determine the appropriate compensation for lost fishery resources. The Commission has done so because Hydro's evidence on fishery impacts was deficient. WHILE THE COMMISSION HAS DEALT WITH THIS DEFICIENCY BY REFERRING IT TO THE MONITORING PROGRAM, THE COMMISSION RECOMMENDS THAT IN FUTURE HEARINGS, SUCH EVIDENCE ON IMPACTS BE SUPPLIED WITH THE APPLICATION.

The Commission believes it would be inappropriate to establish an open-ended monitoring program that could be used to serve a wide range of community or resource planning purposes. THE COMMISSION RECOMMENDS THAT A MONITORING PROGRAM BE ESTABLISHED, CLEARLY DESIGNED TO

SERVE THE TWO PURPOSES OUTLINED ABOVE - TO DEAL WITH UNRESOLVED IMPACTS THAT HAVE BEEN DESIGNATED FOR MONITORING OR WERE UNANTICIPATED AND TO VERIFY COMPLIANCE WITH THE CONDITIONS OF THE ENERGY PROJECT CERTIFICATE. THE COMMISSION FURTHER RECOMMENDS THAT HYDRO FUND AND BE SUBJECT TO THE MONITORING PROGRAM AS A CONDITION OF THE ENERGY PROJECT CERTIFICATE.

3.2 Scope of Program

Hydro recommended that the monitoring program's scope be limited to socio-economic impacts in Fort St. John. Hydro agreed that other municipalities should have access to the monitoring programs if problems arise outside Fort St. John, but they should not assume that the cost of any ad hoc monitoring would be reimbursed by Hydro.

The City of Fort St. John also recommended that the program be restricted to the Fort St. John and Taylor area. It expressed concern that, if the program is responsible for too wide an area, specific problems in the city may be overlooked.

Hudson's Hope and Dawson Creek submitted that the monitoring program should have a broader scope so it could resolve whatever impacts might arise in their communities.

Representatives from provincial government ministries did not comment on the geographical scope of monitoring, but did contend that the monitoring program should not be involved in matters about which a ministry and Hydro had reached agreement.

Professor Andrew Thompson, an expert witness on monitoring called by the municipalities in the region, suggested that the scope of the program should include all areas and impacts as required.

The Commission concludes that, to accomplish the purposes outlined in Section 3.1, the scope of the monitoring program must be sufficiently broad to deal with all impacts designated for monitoring. The following specific matters have been referred to the monitoring program for determination:

1. identification of, and appropriate mitigation and compensation for, financial and infra-structure impacts of the construction on the City of Fort St. John;

2. identification of, and the appropriate mitigation and compensation for, the tax revenue foregone by the Corporation of Hudson's Hope arising from land use precluded by the project and for damage if any to property caused by the project if agreements cannot be reached prior to the issuance of Energy Project Certificate;

3. identification of, and the appropriate amount of compensation, if any, for net increased planning costs of the Peace-Liard Regional District attributable to the project;

4. identification of, and appropriate mitigation and compensation for, the impacts on health and hospital services in Fort St. John;

5. identification of, and appropriate mitigation and compensation for, impacts if any on other social services in the region;

6. identification of, and the appropriate compensation for, impacts of highway relocation and transmission line development on wildlife;

7. identification of, and appropriate mitigation and compensation for social impacts on the native people in the region;

8. determination of compensation for the project's impact on fisheries based on studies as recommended in section 6.2.1 of Chapter XIV.

Intervenors expressed considerable concern regarding impacts which are at this time wholly unanticipated. The Commission concludes that in the area of construction impacts, there are a number of unforeseeable effects that will undoubtedly arise. Many of these can be dealt with on an individual basis as they occur and, consequently, are ideal for a monitoring program. THE COMMISSION THEREFORE RECOMMENDS THAT, WHERE THE CONSTRUCTION PHASE OF THE PROJECT CAUSES IMPACTS NOT ANTICIPATED IN THIS REPORT, AFFECTED PARTIES BE AT LIBERTY TO TAKE THE MATTER UP WITH THE MONITORING PROGRAM.

On the other hand, the Commission does not believe that the long-term effects of flooding the Site C reservoir should be subject to ongoing review under the monitoring program. The Commission draws two distinctions between impacts which are caused by the construction phase of the project and impacts caused by flooding. First, the Comptroller of Water Rights has ongoing responsibility respecting many reservoir impacts, and the Commission does not believe that another level of review is required or desirable. Second, even with the benefit of hindsight, the effects of flooding the lands in the reservoir area will never be completely identified and the potential for further unanticipated effects in the future will always remain. The Commission does not believe that any monitoring program will be better able to determine the actual effects of flooding than the Commission can now. For these reasons, the Commission concludes that it has the responsibility to provide certainty to all parties by determining the appropriate compensation measures wherever possible. With the exception of the few specific matters listed above, which are expressly referred to the monitoring program, the Commission has determined the appropriate compensation for impacts attributable to flooding.

The Commission also concludes that the issues to be dealt with by monitoring should be matters of public rather than private concern. Private disputes should be dealt with through private negotiation and settlement. This is not to say that the monitoring program, with its information and communication resources, cannot assist individuals or Hydro in reaching private agreement. Nor is it to suggest that private individuals who are affected by impacts of a public or general nature should not be able to approach the monitoring program to seek corrective measures. Rather, it is simply to emphasize that private matters that cannot be demonstrated to be of public concern require private resolution.

With respect to the compliance function of monitoring, the Commission concludes that the scope of the program should include all conditions of the Energy Project Certificate. The Commission does not believe that the monitoring program should serve an inspection function. The Commission accepts the view that where a ministry or local government and Hydro are working together to implement a condition of the project, the monitoring program need not oversee their activities. Nevertheless, the program should be available to resolve disputes when a disagreement arises as to whether a condition has been properly implemented. This could happen with respect to any condition of the Energy Project Certificate, and the monitoring program should be broad enough to handle such eventualities.

Finally, the Commission notes that most of the matters referred to the program arise out of the construction phase of the project. ACCORDINGLY, THE COMMISSION RECOMMENDS THAT THE MONITORING PROGRAM TERMINATE UPON COMPLETION OF THE PROJECT. At that time, the monitoring commissioner will have to make a final determination regarding matters that have been referred to him that will have ongoing effects.

3.3 Structure and Responsibilities

Participants in the hearings emphasized that the structure and composition of the monitoring program is critically important in determining its success. In his submission on behalf of the local municipalities, Professor Andrew Thompson observed that:

> Perhaps the most damning criticism of the Revelstoke situation is that the institutional structures for impact mitigation and compensation which are required to justify postponing decisions were not adequately thought out... In particular, no satisfactory explanation has been advanced for placing the monitor within the hierarchy of the regional district and without access to the Water Comptroller. This isolated him from Hydro and from the provincial bureaucracy — the only bodies capable of taking prompt mitigative action... Similarly the time consuming and inefficient treatment of complaints by the various communities shows how little attention was paid to the design of decision-making procedures (Ex 333:33-4).

The Professional Development Advisory Committee recognized the need for accessibility to the public, for close liaison with local and provincial social service agencies, and for direct contact with the major parties involved, including Hydro and the local and provincial government. In its proposal, the staff would provide accessibility to and from the public, the impact monitoring committee would provide the close liaison with local and provincial social service agencies, and the Impact Management Board would provide the direct contact with the major parties involved.

The Commission concludes that the goals of the monitoring program recommended by the PDAC can be achieved with a less cumbersome bureaucratic structure.

The Commission concludes that the monitoring program should be structured so as to be readily accessible to the public and to local provincial ministries and agencies, in order to be well informed on all impact areas for which it is responsible; to be free of bureaucratic burden; and to have clear lines of communication and authority to enable it to discharge its responsibilities quickly and efficiently.

TO THESE ENDS, THE COMMISSION RECOMMENDS THAT THE RESPONSIBILITIES OF THE MONITORING PROGRAM SHOULD BE CARRIED OUT BY A MONITORING COMMISSIONER (APPOINTED BY THE CABINET, PURSUANT TO SECTION 25.1 OF THE UTILITIES COMMISSION ACT, AS AMENDED TO JULY 11, 1982), AIDED BY A SMALL OFFICE STAFF.

The man or woman appointed will require the authority to perform an adjudicative rather than analytical function. The monitoring commissioner should have the authority to hire consultants to assist on technical matters as required.

The monitoring commissioner should establish an office in Fort St. John and make his presence known to the communities and government representatives in the area. All disputes or concerns with respect to unanticipated construction impacts or impacts designated for monitoring, and all disputes about compliance with the specific conditions of the Energy Project Certificate, should be referred to the monitoring commissioner for resolution. Members of the general public and representatives from local and provincial government agencies and departments or ministries should be able to refer such matters to the commissioner.

Upon receiving notice of an apparent impact requiring resolution, the monitoring commissioner must take steps, in consultation with the complainant, Hydro and other interested parties, to assess (1) whether the impact is a matter within the purview of the monitoring program; (2) the nature and magnitude of the impact; (3)the extent Site C is responsible for the impact and (4) mitigation or compensation measures, if any, that should be taken in respect of the impact.

Upon receiving notice of a dispute over compliance with a condition of the Energy Project Certificate, the monitoring commissioner must take steps (1) to assess the nature of the disagreement; (2) to determine whether the conditions had been satisified and (3) to decide what, if any, further measures are required for compliance.

The Commission does not believe a monitoring bureaucracy or large inter-agency committee is needed to assist the monitoring commissioner in his assessments. THE COMMISSION RECOMMENDS THAT THE MONITORING COMMISSIONER AND SMALL STAFF DRAW, AS FAR AS POSSIBLE, ON THE RESOURCES OF EXISTING MINISTRIES AND AGENCIES. THE COMMISSION RECOMMENDS THAT EACH RELEVANT PROVINCIAL MINISTRY DESIGNATE A PERSON, PREFERABLY LOCATED IN THE FORT ST.JOHN AREA, WHO WOULD BE AVAILABLE TO RECEIVE REQUESTS AND PROVIDE WHATEVER INFORMATION AND DATA IS REQUIRED BY THE MONITORING COMMISSIONER IN HIS ASSESSMENTS. LOCAL GOVERNMENTS AND AGENCIES, AS WELL AS HYDRO, SHOULD BE DIRECTED TO DO THE SAME. IF THE INFORMATION AVAILABLE FROM THESE EXISTING SOURCES PROVES INSUFFICIENT, THE MONITORING COMMISSIONER SHOULD BE ABLE TO COMMISSION STUDIES TO EXAMINE SPECIFIC ISSUES.

THE COMMISSION RECOMMENDS THAT THE MONITORING COMMISSIONER HAVE THE AUTHORITY TO ORDER HYDRO TO TAKE SUCH MEASURES AS ARE DETERMINED TO BE APPROPRIATE THROUGH HIS ASSESSMENTS AND TO ADVISE THE APPROPRIATE MINISTRIES OF THE NECESSARY ACTION, BASED ON THE MITIGATION AND COMPENSATION PRINCIPLES USED FOR ESTABLISHING THE CONDITIONS OF THE ENERGY PROJECT CERTIFICATE. THE MONITORING COMMISSIONER'S DECISIONS SHOULD BE SUBJECT TO

APPEAL. TO PROVIDE AN APPROPRIATE PROCEDURE, THE COMMISSION RECOMMENDS THAT THE MONITORING COMMISSIONER BE A TEMPORARY OR PERMANENT MEMBER OF THE B.C. UTILITIES COMMISSION. THE MONITORING COMMISSIONER'S DECISIONS WOULD THEN AUTOMATICALLY BE SUBJECT TO RECONSIDERATION UNDER SECTION 114 OF THE UTILITIES COMMISSION ACT. SUCH AN ARRANGEMENT WOULD ALSO HELP TO ENSURE CONSISTENCY IN THE PRINCIPLES APPLIED TO REGULATED UTILITIES AND PROJECTS UNDER THE COMMISSION'S AUTHORITY.

3.4 Funding

Participants in the hearing generally agreed that funding for the monitoring program should be provided by Hydro. However, the extent of Hydro's liability and control over program costs was raised as an issue.

The Commission concludes that an appropriate level of funding for the monitoring program should come from Hydro as an expense of the project, but that the budgetary control for the program should be the responsibility of the B.C. Utilities Commission.

THE COMMISSION RECOMMENDS THAT HYDRO BE REQUIRED, AS A CONDITION OF THE ENERGY PROJECT CERTIFICATE, TO PROVIDE BASE FUNDING FOR THE MONITORING COMMISSIONER'S SALARY AND HIS OFFICE COSTS AND STAFF IN AN AMOUNT DETERMINED BY THE B.C.UTILITIES COMMISSION, CONSISTENT WITH ITS NORMAL PRACTICE. ADDITIONAL FUNDING SHOULD BE REVIEWED BY THE B.C. UTILITIES COMMISSION BASED ON THE MONITORING COMMISSIONER'S RECOMMENDATIONS.

Over and above base funding, the monitoring commissioner should have the authority to order Hydro to pay further amounts for (1) additional staff or special studies as required for impact assessment; (2) mitigation measures; and (3) compensation measures.

HYDRO SHOULD HAVE, ON REQUEST, THE RIGHT TO HAVE ANY OF THESE ORDERS REHEARD BY THE B.C. UTILITIES COMMISSION. THE COMMISSION THEREFORE RECOMMENDS THAT CABINET DIRECT THE PERMANENT COMMISSION TO RECONSIDER ANY DECISION OF THE MONITORING COMMISSIONER WHICH IS CHALLENGED BY HYDRO.

THE COMMISSION RECOMMENDS THAT COSTS INCURRED BY COMPLAINANTS IN BRINGING A MATTER TO THE ATTENTION OF THE MONITORING PROGRAM BE BORNE BY THE COMPLAINANTS THEMSELVES, UNLESS THE MONITORING COMMISSIONER SPECIFICALLY ENGAGES THE COMPLAINANT AS A TECHNICAL CONSULTANT TO ASSESS A PARTICULAR IMPACT OR THE COMPLAINANT SUCCESSFULLY ARGUES THAT ITS COSTS SHOULD BE MADE PART OF A SOCIAL OR NATURAL RESOURCE IMPACT COMPENSATION AWARD.

CHAPTER XVII PROJECT IMPACTS: CONCLUSIONS AND RECOMMENDATIONS

1.0 SUMMARY OF POSITIONS TAKEN BY HYDRO AND INTERVENORS

1.1 Hydro's Position

In final argument, Hydro stated that "from a provincial perspective the environmental and socio-economic impacts would not be very great and the proposed mitigation and compensation measures will offset impacts which would otherwise result in regional inequities" (112:18,206).

More specifically, Hydro summarized its position on project impacts as follows:

The environmental impact studies it commissioned were sufficiently comprehensive and detailed for the Site C decision, and met the requirements of the government, having been reviewed by government agencies in 1978 and 1979.

Hydro argued that its consultants used realistic parameters to assess the significance of the agricultural lands affected or lost as a result of Site C, whereas the Ministry chose assumptions that inflated values to unreasonable levels. Hydro did not accept that compensation should be paid for Crown land or that the compensation options provided by the ministry were economic or justifiable. If compensation to the Crown is required on economic efficiency grounds, Hydro argued that the $1.2 million loss which it calculated for Crown lands would be the appropriate figure. Hydro argued that the project would not preclude a vegetable industry.

With respect to arguments presented by Peace Valley Environmental Association's witnesses, Hydro pointed out that, in retrospect, most of them were not in disagreement with Hydro's evidence. Specifically, Dr. Manning agreed that physical capability of land was only one of many factors that should be considered in resource allocation, and it is this one factor that Hydro had emphasized; and Dr. Bentley stated that the land would not necessarily be lost forever as many intervenors suggested. Finally, Hydro maintained that Dr. Warnock's evidence was further undermined by his admission that he has no expertise in economics and soil science.

With respect to climate, Hydro argued that the impacts will generally be insignificant. The expected increase in wind speed will neutralize the effect of dense fog on crop drying.

With respect to forestry, Hydro argued that the evidence shows that much of the forest resource is not presently economically recoverable and therefore no compensation should be paid. Hydro argued its proposed clearing will be adequate for future recreational use of the reservoir.

With respect to recreational impacts, Hydro argued that its proposed compensation program, at a cost of $5 million, would more than offset the project's adverse impacts and reflects local preferences. It argued it should be responsible for constructing and operating the facilities and noted the Ministry's witnesses agreed that Hydro could do this efficiently.

With respect to wildlife and recreational hunting impacts, Hydro argued that its proposed $700,000 compensation program is adequate. Hydro contended that a number of assumptions used in the Ministry's analysis are unjustifiable and that the Ministry's proposed $3.5 million program is out of proportion to the value of the resource loss.

With respect to fishery impacts Hydro noted that its evidence shows that, in the long run, the reservoir will be more productive than the river. Hydro argued that $1.9 million is the most appropriate figure for the compensation program. It was confident that details of the program could be worked out with the Ministry of Environment. Hydro acknowledged that mercury levels in fish in the Site C reservoir may increase, but stated that those increases would be temporary.

Based on information obtained in Williston Lake, Hydro did not believe that there would be a hazard to sports fishermen.

With respect to downstream water quality, Hydro argued that the project would have little impact. Regarding Westcoast's concern about impacts on water quality, Hydro indicated it is prepared to install a monitoring system to collect adequate data, details of which will be negotiated with Westcoast.

With respect to heritage resources, Hydro stated that the studies it has funded have cost more than $600,000 and are the most comprehensive undertaken by any developer in the province to date. Hydro argued that no further compensation is warranted.

With respect to socio-economic impacts, Hydro acknowledged its responsibility and proposed to negotiate compensation details with local governments and the Regional District for impacts caused by the project, and indicated that monitoring should be used to identify such impacts.

With respect to specific municipal issues, Hydro argued that it should not be responsible for Taylor's water intake design, since the design was based on erroneous assumptions made by Taylor's engineering consultants. Hydro agreed that a berm should be constructed along the overburden bank to protect Hudson's Hope property owners.

With respect to labour and local economic impacts, Hydro argued that the hiring process used on past hydroelectric developments has been successful and should be used for Site C.

With respect to rural impacts and its land acquisition policy, Hydro stated its decision to purchase lands prior to project certification was in response to land owners' requests. It argued that while some land owners were upset by this policy, the majority were apparently satisfied with their treatment.

With respect to impacts on Indians, Hydro acknowledged the active native hunting economy in northeast British Columbia, but argued that this would not be precluded by Site C. Hydro's proposed wildlife compensation package is aimed at maintaining existing levels of wildlife populations for both Indian and non-Indian hunters. Hydro argued that compensating Indians for cumulative impacts caused by development in the region is a matter of government policy, and far beyond Hydro's responsibility. Regarding charges that its data on native impacts were inadequate, Hydro argued that its consultant accurately identified areas of potential impact but could not quantify the impacts due to the Indian's reluctance to provide the necessary information.

I.2 Intervenor's Positions

Not all intervenors presented a final position on project impacts. The positions of those who did are summarized below.

The Ministry of Agriculture and Food categorically denied that it chose assumptions simply to inflate the value of agricultural land in order to maximize its compensation request. It argued its approach was consistent with the benefit-cost guidelines.

The Ministry of Environment denied that it endorsed Hydro's studies as adequate. It further argued that its estimates of the value of losses were more accurate than Hydro's.

The PVEA (Peace Valley Environmental Association) stressed the inadequacy of Hydro's resource impact studies. PVEA argued that Hydro grossly underestimated the value of the agricultural resource loss and failed to take the superior micro-climate of the valley into account; that the broader issue of security of food supply should be considered; that the fishery studies were inadequate because existing habitat and populations were not identified, angling activity was not properly assessed and the value of the river fishery was underestimated; that the mercury problem was not addressed; that Hydro's wildlife study was an inappropriate assessment of the resource because the carrying capacity of the land was not addressed, the time frame of the study was too restricted and the impact of snowshoe hare cycle on furbearers was not considered; that Hydro's recreation impact study was deficient because of problems in survey methodology; and finally that Hydro's heritage resource inventory lacked sufficient base-line data. Finally, PVEA argued that Hydro did not make any serious attempts to assess impacts on the native economy.

The City of Fort St. John indicated that it was not opposed to the project, but argued that, as conditions of the Energy Project Certificate (1) Hydro should be required to negotiate a mitigation and compensation agreement with the city, (2) an impact monitoring organization funded by Hydro should be set up with direct access to Cabinet and with authority to enforce its decisions, and (3) an arbitration procedure should be established for making final determinations where negotiated agreements cannot be reached. The Fort St. John Hospital stressed that existing difficulties will be aggravated by the construction of Site C.

The other local governments and Regional District argued that, as a condition of the Energy Project Certificate, the impact management and monitoring structure recommended by Professor Thompson should be established and be funded by Hydro. They recommended that the Utilities Commission retain continuing jurisdiction in the arbitration process.

The Treaty 8 Tribal Association recommended that the region's wildlife enhancement programs should be managed by Indians, that sports hunting in the heartlands of Indian hunting territories should be restricted, that the south shore of the Peace River should not be opened up, and finally, that socio-economic mitigative measures should be designed and implemented by Indians themselves.

Mr. L. Rutledge concluded that the intrinsic values of the Peace Valley cannot be broken down into individual resource components and cannot be assigned monetary values.

Mr. Hadland argued that Hydro's estimates of the project's impacts on agriculture, recreation and wildlife were inaccurate, and that Hydro's water quality, forestry and heritage resources studies were inadequate.

The B.C. Federation of Agriculture argued that Hydro has no expertise in agricultural matters and that many of its assumptions were unjustified. It recommended that if Site C proceeds, the government should be compensated for lost Crown land and a special impact committee established. Flood reserves should be removed regardless of the Site C decision.

The National Farmers Union argued that Hydro has no genuine understanding of the significance of flooding agricultural lands and that the value of agricultural land would become more important to society in the future.

Westcoast Transmission argued that the evidence does not support Hydro's position that Site C is unlikely to affect downstream users. It argued that water-quality monitoring be made a condition of the Energy Project Certificate. It also indicated that, if any significant impacts do occur, Westcoast will pursue remedies under the Water Act and seek compensation.

2.0 THE COMMISSION'S POSITION ON PROJECT IMPACTS

The Commission recognizes that the Site C project will have lasting, profound effects on the Peace River Valley, and considered all the views and concerns of the ministries, agencies and local governments who have responsibilities in the area, and of the people and groups who reside in the area and will be directly affected.

The Commission has concluded that the project impacts can be managed in such a way as to render them acceptable from the regional and provincial point of view. This is not to say they will be acceptable to everyone. The Commission recognizes that, for some, the loss of the valley in its present state or the loss of a home and lifestyle cannot be offset or diminished in any way. It is simply a loss to be borne, if it can be clearly demonstrated to be in the interest of the province as a whole.[1]

In concluding that the project's impacts can be rendered acceptable, the Commission believes that, with appropriate measures, the impacts in many respects can be minimized, quantifiable losses can be compensated, and monitoring can be undertaken to identify and resolve impacts arising during the course of the project. The valley cannot be replaced, but the region and the province can generally be left no worse off as a result of the project's effects.

The Commission notes that considerable concern was expressed about the quality of the data and adequacy of the impact assessments presented at the hearings. While additional evidence would have been highly desirable. the Commission has concluded, based on the evidence presented by Hydro and its consultants, by provincial government ministries, by local governments and groups, and by private intervenor witnesses, that reasonable judgements in most instances can be made on the nature and magnitude of the project's impacts and on the measures that should be taken. This the Commission has attempted to do. Where evidence was inadequate the Commission has identified the steps to be taken prior to proceeding any further with the project.

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[1] The conditions which the Commission has recommended be satisifed prior to the issuance of an Energy Project Certificate (See Chapter X) are, in part, motivated by a concern that residents of the Peace River Valley not be asked to bear the brunt of the project's impacts until it can be demonstrated to be in the provincial interest.

The Commission's specific recommendations are outlined in Chapters XIV, XV and XVI and summarized in Chapter II. They include an extensive list of mitigation measures that the Commission recommends be made conditions of the Energy Project Certificate. They include a compensation package totalling $29.8 million for the estimated economic value of the resources (excluding fisheries) that will be lost as a result of the project (see Table 17), and a presently undefined amount for cost impacts on local communities and social service agencies. The Commission also recommends that a monitoring program be established with the authority to identify and resolve those impacts most appropriately dealt with as they arise.

The Commission concludes that full and proper impact management requires not only that conditions be imposed on Hydro but also that appropriate measures be taken by government. The Commission has recommended a number of measures that the government should take to minimize adverse effects of its project-associated activities, for example, construction of Highway 29, to ensure that appropriate compensation programs are undertaken in order to enhance remaining resources in the region, and to respond quickly and efficiently to requirements such as health and hospital services needs which may arise during the construction of the project.

TABLE 17

The B.C. Utilities Commission's Recommended Compensation Package[1]

A. Resource Compensation

Agriculture	- $18.6 million
Forestry	- $1.0 million, less present value of stumpage plus transmission line impacts to be identified
General Recreation	- $6.9 million
Wildlife	- $2.8 million
Fisheries	- to be estimated
Heritage Resources	- a maximum of $0.5 million in matching funds raised by the Heritage Conservation Branch for implementing the program
TOTAL (known)	- $29.8 million

B. Social Impact Compensation

Local Governments	- to be identified by the monitoring program
Social Service Agencies	- to be identified by the monitoring program

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[1] Figures are based on the hybrid discounting procedure and are reported in constant 1981 dollars. A 1985 construction start-up date is assumed for the calculations.

In sum, while the Commission recognizes that major impacts will result from the Site C project, the Commission concludes that they are not so large as to make them unacceptable. Provided that appropriate conditions are placed on Hydro and that the government responds to the special needs created in the region, the impacts can be successfully and acceptably managed.

PART SIX COMMUNITY & SPECIAL HEARINGS

CHAPTER XVIII BRIEF SUMMARY OF STATEMENTS AT COMMUNITY AND SPECIAL HEARINGS

1.0 INTRODUCTION

At an informal public meeting held in Fort St. John on July 30, 1981 as part of the pre-hearing proceedings, a number of intervenors voiced concerns about the intimidating aspect of appearing before the Commission during its formal daytime sessions. Among the problems cited were those of having time to appear during the day and fear of being closely cross-examined. It was also suggested that allowing people to voice their opinions in their own communities would be fairer.

To address these concerns, the Commission decided to hold less formal evening hearings at which Hydro would not present evidence or be cross-examined and where the intervenors, registered or not, could express their opinions informally. The Commission also ruled that no cross-examination would be allowed, although, if questions did arise, the chairman would consider them and if they were appropriate, would put them to the intervenor. All commissioners were, of course, free to question any witnesses.

A verbatim record of these hearings was made and submitted briefs were entered as exhibits.

Six such meetings were held in 1982 in Fort St. John (Feb. 11 and June 22), Taylor (Feb. 18), Hudson's Hope (Feb. 25), Chetwynd (Mar. 3) and Dawson Creek (April 1). Sixty-three witnesses were heard either on their own behalf or on behalf of various organizations at these less formal hearings.

The Indian bands comprising the Treaty No. 8 Tribal Association invited the Commission to visit their reserves to hear the band members concerns. They felt that the members would be more at ease and therefore better able to express themselves. In addition, they felt that the commissioners would have a better appreciation of their concerns after visiting the reserves.

The Commission accepted this invitation and held three daytime special hearings. The arrangements were the same as for the less formal hearings. The Tribal Association provided interpreters so that band members could speak in their own languages. Three such special hearings were held in 1982. On March 4, the West Moberly and Saulteau bands were heard near the West Moberly Reserve. On March 18, the Blueberry and Doig Bands appeared before the Commission on the Blueberry Reserve. And on March 25, the Halfway Band appeared before the Commission on their own reserve. Forty-seven band members spoke to the Commission at these special hearings.

In the less formal hearings, intervenors expressed opinions on most aspects of the application. These opinions are grouped and summarized below in terms of the five phases of the formal hearings. Sections 2 through 4 summarize the demand, supply and project design comments, respectively. Section 5 summarizes the socio-economic and environmental issues, which concerned a large majority of speakers. Section 6 presents comments pertaining to financial matters.

2.0 DEMAND-RELATED TOPICS

Several speakers opposed to Site C expressed their distrust of Hydro's demand forecast. Their skepticism was due, in part, to their view that Hydro had not incorporated price into its forecast. However, several speakers in favour of the project, particularly at the Fort St. John hearing strongly indicated that estimation of demand is best left to experts at Hydro. If Hydro's demand forecasts show Site C is necessary, then the project should proceed. Concern over the possibility of brownouts was also voiced.

One speaker stated that Site C will never pay for itself since demand is highly sensitive to price. He noted that Hydro itself recognizes that industrial demand, a major component of total demand, is highly price sensitive. He added that the current rate structure subsidizes large industrial users at the expense of the residential user. Another speaker suggested that, if price is an important variable in shaping demand, then the results of the B.C. Utilities Commission's hearings on Hydro's proposed rate increase should first be completed before attempting to evaluate the Site C application.

A speaker at the Fort St. John hearing cited studies by Helliwell and Margolick, and Levelton indicating that the cogeneration of electricity is economic and that sawmills and plywood mills could become largely self sufficient if Hydro purchased their excess power at a rate more reflective of its own marginal cost.

Participants at these hearings frequently commented on the need to increase energy conservation in the province. Of the 110 speakers, 17, or 15%, expressed the need for increased conservation to reduce the demand for electricity. Because B.C.'s industry is very energy intensive, it was argued that conservation measures could have great impact on reducing demand.

Suggested conservation measures included discouraging the development of industries with large power requirements, such as aluminum smelters, and modifying building codes to induce energy-conserving measures (for example, proper insulation).

One speaker noted that, in Oregon, the utility company makes planned expenditures to promote conservation. He also noted that the Pacific Northwest of the U.S.A. has already dammed all its major rivers and suggested that B.C. should start conserving before it finds itself in the same position. A speaker in favour of the dam pointed out that conservation is much talked about but not widely implemented.

3.0 SUPPLY-RELATED TOPICS

Most comments relating to the issue of supply focused on developing alternative energy sources. Several speakers felt that these alternatives, in conjunction with conservation, would not only reduce the demand for electrical energy in total, but also the excess capacity required for periods of low water. In other words, they felt that diversification of supply would improve the system's flexibility and increase capacity utilization. Others mentioned the possibility of renegotiating the Columbia River Treaty and retrofitting the existing Duncan and Keenleyside dams to produce greater output.

Several speakers felt that the available supply of electrical energy could be increased if Hydro would pay small-scale producers a rate equal to its marginal cost. This would encourage cogeneration by industry, small hydro and other power production by individuals.

Several speakers cited various energy alternatives to hydroelectric power. One recommended greater use of natural gas. He questioned the practice of exporting natural gas to the U.S. while continuing to dam rivers. Another speaker described the process of mining metallurgical coal, which produces soft thermal coal that could be used to generate electricity. Finally, several speakers advocated that the possibilities of generating from solar and geothermal power be seriously explored.

Those in favour of the project indicated that, if Hydro and the B.C. government felt the additional supply that Site C would provide is needed, then the project was justified. Several speakers in favour of Site C cited costs, adverse effects, potential dangers and health hazards of conventional alternative energy sources, such as nuclear, coal and oil-fired thermal plants, as justification for Site C or hydroelectric development generally.

4.0 DESIGN

Because the design of Site C is inherently a highly technical issue, speakers at these hearings could only make general comments. Several voiced concerns over the flood lines established by Hydro. In particular, native speakers feared being flooded out. They stated that the flooding associated with the Bennett dam exceeded the preliminary floodlines. Others feared that heavy sloughing would result in mud slides that would burst the dam. One speaker noted Site C's susceptibility to being bombed. Another speaker suggested lowering the height of the dam so as not to flood Hudson's Hope.

Many speakers raised the issue of bank stability and the problem of bank sloughing. A speaker at the Hudson's Hope hearing complained that the safeline was close to the school and library and that sloughing beyond the safeline would imperil these structures. To prevent this occurrence, he suggested a barrier be built along the bank. Several individuals, citing the recent experience with bank instability at the Williston reservoir, felt that, ultimately, the road from Fort St. John to Hudson's Hope will have to be moved further and further back, thus impinging on available farmland.

5.0 SOCIO-ECONOMIC AND ENVIRONMENTAL IMPACTS

The majority of the speakers addressed the social and economic impacts of Site C.

5.1 Economic Impacts

Most speakers in favour of Site C mentioned the need for economic growth and development in the area. They felt that Site C would provide a welcome and needed "shot in the arm" for Fort St. John and vicinity. It would generate employment and increase local spending. The potential development of secondary industry and increased tourism were emphasized as positive impacts. One speaker stated that Fort St. John would have no trouble accommodating the influx of workers.

Several supporters of the project felt that hydroelectric power is far superior to any of the currently available alternatives: coal is too dirty; atomic energy is too dangerous; and oil is too expensive. In addition, the project will ensure against brownouts and slow economic growth resulting from lack of power.

Those opposing the dam noted that the construction phase of a megaproject, such as Site C, exacerbates the boom and bust cycle that commonly plagues community development in northern B.C. And while the employment impacts of construction are significant, they are nonetheless temporary. Long-term employment in Hudson's Hope from the Bennett and Site One dam amounted to 25 jobs. The social impacts experienced at Hudson's Hope and the Williston Reservoir were described as ones to be avoided. Several speakers felt that employment opportunities during construction will not be great because of the lack of skilled local labour and the hiring practices of unions. Furthermore, some claimed that Hydro had not lived up to its promises to employ local labor during the construction phases of Site One and Bennett dams.

A speaker at the Taylor meeting was sceptical about the distribution of any positive impacts. He felt that only the wealthy will benefit. Another pointed out that, since the workers are tentatively scheduled to be flown into the construction site for a 12-day shifts and then flown out for five days, local spending and re-spending will be minimal.

Opponents also noted that industrial development had not resulted from the Site One or Bennett dams and that there is no reason to expect secondary industrial development to follow Site C. Others referred to the adverse impact of increases in local prices once workers arrive in Fort St. John. Those on fixed incomes, particularly native people who depend on hunting and trapping, would suffer the most from local inflation.

Finally, opponents stated that the reduction in Fort St. John's agricultural base would reduce the agriculture-dependent sales of local industries and businesses. Thus, Site C would result in a lower level of local employment and spending once the dam is completed.

To maximize local employment, some suggested that local training programs be set up before the project begins so that local workers will have the required skills. Others suggested that lower power rates be offered to industries locating in the Fort St. John area.

5.2 Native Impacts

The primary concern of the native speakers was the threat posed by Site C to their way of life and livelihood. The perception of this threat resulted in unanimous opposition by native speakers to the Site C project.

Native speakers estimated that almost all of the income generated by natives in this region comes from hunting and trapping and that 90% of the natives trapped. The bands complained that they were already suffering trapline damage from Hydro's preliminary work. They feared that Site C would flood substantial reserve lands which are currently used by natives for their subsistence activities, as well as native burial grounds. Several speakers were worried that some of the best wildlife grazing lands, in particular grazing areas for moose, will be flooded, forcing game further back into the woods and drowning many animals as the dam comes into service. Some also claimed that fish stocks would be substantially depleted as a result of Site C, particularly from blasting during construction.

Some speakers claimed that the development of Site C will provide recreational hunters with greater access to stocks that are now utilized almost exclusively by natives. Several speakers pointed out that local bands were experiencing trouble with poachers damaging and stealing from traplines, thieves breaking into their cabins and trophy hunters wasting animal resources. They also felt, that as the area is opened up, natives using horses for transportation while hunting would have trouble competing with recreational hunters, who can afford all-terrain and four-wheel drive vehicles.

Concern was also voiced about the reservoir backing up and silting and polluting Moberly Lake.

Some speakers expressed resentment over their treatment by Hydro during construction of the Site One and Bennett dams. The natives had signed "Treaty 8" with the Federal government which they believed provided them hunting and trapping rights and ownership of the land in perpetuity, yet their land was confiscated without compensation by the provincial government. Several speakers noted the lack of native input into the planning of these projects to mitigate the adverse consequences. They also noted Hydro had not addressed native concerns in its compensation plan. They claimed that Hydro had not kept its promise to hire native labour for the construction of the Site One and Bennett dams. And while a native training program had been instituted when the project was about to begin, by the time the natives were ready to look for jobs, it was too late.

They also pointed out that natives benefit the least from booms since they are last to get jobs and suffer from local inflation, and they suffer the most during the downturn as job opportunities dry up and social services are curtailed.

The native people are anxious about the large influx of workers into Fort St. John. They anticipate increased discrimination and harassment when in town buying necessities, increased levels of crime and violence, and reduced social services — education, health care, etc. — as pressure on them increases.

The Halfway Reserve, which has no electricity, expressed wonder that Hydro could build huge towers and transmission lines to supply the Lower Mainland and the U.S. yet could not provide a nearby reserve (which is bearing a large proportion of the project's adverse impacts) with power.

The native people are most concerned about the threat to their way of life. All 37 native speakers focused on this concern. They feared that while Site C might provide some short-term employment for those fortunate enough to find work, the environmental impacts of the dam might prevent a return to subsistence activities after construction is complete. They claimed, furthermore, that the losses they would incur - wildlife, fish, medicinal herbs, berries, grazing land and so on - could not be compensated for. Any change in native lifestyle will have a substantial impact on the tribal elders who will not be able to adapt easily. Compensation cannot provide a way of life for future generations - the spiritual well-being of the native population is tied to living in harmony with their environment which they claimed would no longer be possible after Site C. In fact, Site C will increase the likelihood of increased assimilation into the white culture, making it even more difficult for the tribes to maintain and perpetuate their culture.

Some native speakers did mention certain compensation measures that could improve their plight. They suggested that natives be given new hunting and trapping areas in conjunction with extensive restocking of fur-bearing species, and that natives work with provincial fish and wildlife officials to minimize the impact of poaching and recreational hunting.

They also suggested that job training programs for natives begin well in advance of the project's start up date to increase the likelihood of native hiring. This could incorporate financial assistance from the federal Department of Indian and Northern Affairs who, according to the tribes, have not been of much help in the past.

5.3 Agricultural Impacts

Many participants contended that Site C imposes unacceptable, long-term agricultural losses on the Peace region. They claimed that the agricultural land to be flooded is of such high quality and has such a unique microclimate that it is irreplaceable. Others disputed this claim: they said that a lot of comparable land was available and that soil enhancement would make even more nearby land available. They claimed, too, that the reservoir would have a tempering effect on the area's climate, which will prolong the growing season and thus make a lot of nearby land comparable to what will be flooded. This latter opinion was disputed by speakers opposed to the dam; one farmer noted that the effect of the Bennett dam was detrimental to agriculture. Supporters stated that the reservoir will increase the number of frost-free days at higher elevations thus improving the productivity of potential alternative agricultural land.

Many speakers noted that B.C. has a scarcity of agricultural land (less than 10% of total land is arable) and that the province currently imports about half its produce. Given that North America is rapidly losing farmland while its population is increasing, it was argued that B.C. cannot count on its ability to import produce in the long run.

Even if imported produce is available, one speaker noted that its price is dependent on fuel and transportation costs, which are likely to increase substantially over time, and on the exchange rate, which is impossible to predict. Others felt that, if the loss of agricultural land is a continuing trend, then the prime land in the Peace River Valley should not be flooded because its long-term value cannot be measured in terms of dollars. Several opponents of the dam thought that Hydro's estimate of the agricultural losses are understated because the valley has been in the flood reserve since 1963, and this has interfered with agricultural development.

While alternative land would have to be part of a compensation package to farmers displaced by Site C, most speakers thought that comparable land was not available nearby. One participant proposed that B.C. Hydro provide large greenhouses to restore the ability of the region to grow its own produce.

5.4 Recreational Impacts

Next to the loss of agricultural land, opponents of Site C mentioned most frequently impacts on the recreational opportunities of the Peace River Valley. They emphasized the potential loss of a unique and beautiful river valley. Camping, picnicking, watching waterfowl and wildlife, hunting and boating will all suffer. The flooding of winter range and grazing lands used by newborn moose, elk and deer will reduce wildlife stocks and thus the quality of hunting opportunities.

Site C opponents argued that fishing will be diminished as blasting from construction kills off substantial stocks and the value of these recreational opportunities will increase over time as they become scarcer. They also claimed that such fishing values cannot be evaluated properly in quantitive terms. In addition, they felt that tourists coming to the area for recreation would decrease significantly. Finally, they expressed doubts about Hydro's assessment of the adverse recreational impacts.

Supporters of the project acknowledged the loss of certain recreational activities but felt that, with adequate compensation and mitigation, the losses would not be too great. Also, several speakers commented that certain recreational activities, such as canoeing and boating, had already been affected by the Bennett and Site One dams so that the further impact of Site C will be minimal.

Suggested compensation included habitat enhancement for wildlife on a no-net-loss basis, restocking the reservoir with walleye, construction of a fish hatchery, new boat launches, picnic sites and camping areas. An important mitigation proposal called for clearing the reservoir of debris not only before flooding, but on an annual basis thereafter. One participant noted that, if Williston is an example of mitigation, recreation opportunities on the reservoir will be close to zero. Bank stability was felt to be a key factor in determining the suitability of the reservoir for recreation.

5.5 Archaelogical and Heritage Resources

The main point made by speakers addressing archaelogical concerns was that very little is known about the potential value of archaelogical findings in the region because so little work has been done. Certain heritage structures would be adversely affected, such as the Rocky Mountain Fort and Old Fort. A speaker complained that, during the construction of the first dam at Hudson's Hope, local historical archaelogical societies had no opportunity to examine fossils.

Several speakers suggested as compensation that Hydro provide financial assistance in establishing a local museum. Another suggested the reconstruction of Rocky Mountain Fort at another location.

5.6 Social and Cultural Impacts

Concerns about adverse social and cultural impacts were primarily related to the influx of population during the construction phase of the project. Opponents feared increased crime, overcrowded schools and overburdened medical and health related facilities. Supporters, however, stated that the Fort St. John area could easily accommodate the influx of workers and that the influx would benefit the area's development.

Opponents of Site C stated that Hydro had shown a callous disregard for the residents of the valley by withholding information, dislocating long-time residents and downplaying adverse impacts. Others said that many residents of the Peace originally moved there to get away from development and thus cannot be compensated for Site C. Another adverse impact is Hydro's purchases of private lands which renders them tax-exempt thereby reducing the tax-base. At the same time, the construction phase, with its influx of population, requires additional expenditures to provide essential services. Hudson's Hope was cited as an example of this problem.

5.7 Other

Many speakers referred to the impact of Site C on the local climate. One felt Hydro was intentionally understating the adverse impacts. Several thought that fog in the winter would necessitate relocating the airport and wondered if Hydro would pay for the move. Another stated that the prospect of the dam has lowered property values and thus inflicted lossess on valley inhabitants.

Several speakers stated that the decision to proceed with Site C had already been made in Victoria and that the Commission was appointed to approve the dam.

Finally, two speakers criticized Hydro's inflexibility regarding alternative routes for the new road to minimize agricultural losses. One speaker complained that highway paving interferes with livestock grazing and farmers' privacy.

The province was criticized for the level of its participation in the analysis of the land and resource impacts of Site C. One speaker claimed that the B.C. Ministry of Lands, Parks and Housing had been instructed not to intervene in the Site C hearings.

6.0 FINANCIAL TOPICS

The concerns relating to the financial aspects of Site C included the cost of Site C, the amount of debt to be incurred by B.C. Hydro and the potential burden on Hydro's customers.

Several speakers thought that Hydro had not examined the costs of the project carefully enough. Another doubted that the project would be cost effective, particularly if demand is highly price sensitive, and cited a B.C. Hydro study describing industrial demand as such. This speaker also doubted Hydro's ability to recoup its debt by selling power for export. On the other hand, several speakers at the Fort St. John hearings argued that hydroelectric power was the most cost efficient and that alternatives would impose even higher costs.

Eight different speakers commented on the size of Hydro's debt and the increase in debt required to finance Site C. One speaker stated that Hydro has only been able to pay the interest on existing debt but none of the principal. Moreover, previous debt was incurred at lower interest rates and future debt would be more expensive. Several speakers doubted Hydro's ability to amortize its debt, particularly if the debt increases as planned to approximately $26 billion. One speaker in favour of the dam thought that the project should be started immediately, since a delay would serve only to increase its costs. Another suggested that Hydro should not be permitted to finance new projects without the majority of capital on hand and that this capital be derived from revenues accruing on the basis of a balanced marginal cost rate structure.

Several speakers stressed that B.C. electricity users will ultimately have to pay for Hydro's debt burden, and that if Hydro's timing of Site C is premature, the residents of the province will bear the costs.

7.0 ASSESSMENT OF THE LESS FORMAL AND SPECIAL HEARINGS

The Commission concludes that the less formal and special hearings were essential to the Site C hearing process. They provided an opportunity to hear the opinions of 110 intervenors, many of whom would otherwise probably not have appeared. The Commission believes that by holding these hearings it avoided missing a segment of the public voice because of the formal and, to some, intimidating nature of the formal hearings.

Most of the matters brought out at these hearings were similar to concerns presented in evidence and cross-examined at the formal sessions. Nevertheless, some new opinions were expressed. These have formed a part of the Commission's considerations.

IN SUMMARY, THE EVIDENCE PRESENTED AT THE LESS FORMAL AND SPECIAL HEARINGS HAS BEEN GIVEN APPROPRIATE CONSIDERATION IN FORMING THE COMMISSION'S CONCLUSIONS AND RECOMMENDATIONS.

PART SEVEN OTHER MATTERS

CHAPTER XIX OTHER APPROVALS

1.0 INTRODUCTION

Hydro will be required to obtain a number of provincial permits and licences in addition to an Energy Project and an Energy Operating Certificate in order to construct and operate Site C.

The terms of reference for this hearing specifically directed the Commission to hear and consider:

> "whether an approval, licence or permit should be made given, or issued under Sections, 4, 5, 7, 8, 9, or 10(4) of the Pollution Control Act and under Sections 6, 7, 10 or 11 of the Water Act, including all matters regarding the Applicant's Water Licence Application filed in accordance with the Water Act"

At the time the terms of reference were issued, Section 20(2) of the Utilities Commission Act expressly provided for this direction to the Commission. Since they were issued however, Section 20(2) has been amended[1]. The reference to the Pollution Control Act, which has been repealed, has been replaced by a reference to the equivalent section of its successor act, the Waste Management Act.[2] The Commission has therefore interpreted its mandate to require it to consider whether appropriate authorizations should be issued to Hydro under the Waste Management Act.

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[1] Utilities Commission Amendment Act, 1982, S.B.C. 1982, c. 54.

[2] S.B.C. 1982 c. 41.

2.0 THE WATER ACT

2.1 Hydro's Position

Hydro submitted that it requires a Water Licence pursuant to Section 10 of the Water Act and a licence to flood Crown land pursuant to Section 23 of that Act (Ex 15: D-1). In the case of Site C, the granting of a Section 23 licence should be a matter of course if a Water Licence is granted pursuant to Section 10 of the Water Act. Accordingly, the Commission's considerations focus on Hydro's application for a Water Licence pursuant to Section 10.

Hydro applied for a Water Licence on December 30, 1980. During the hearings Hydro did not suggest any conditions which it thought should be attached to the Licence but did indicate that it found acceptable a number of the conditions contained in the draft Water Licence prepared by the Ministry of Environment (Ex 152: A43-5). In final argument, Hydro indicated its general agreement with that form of Licence.

2.2 Ministry of Environment

The Ministry of the Environment filed a draft Water Licence for the Commission's consideration but emphasized that the conditions included in the draft might need to be reconsidered in light of any additional evidence and argument forthcoming during a public hearing. The Ministry therefore did not address the positions of existing licensees under the Water Act who might be affected by the Site C project. The Commission did hear evidence from existing licensees and its conclusions pertaining to them are presented in Chapter XIV, Section 7.2.

The Ministry emphasized the ongoing nature of the review process particularly respecting engineering design matters. It recommends that its consultants conduct continuous review of the evolving design of Site C, as has been done on past dams.

The draft Water Licence submitted by the Ministry contained 16 separate conditions. Some of these were merely administrative and were not the subject of detailed discussion during the hearing. Others were more contentious and are considered separately in the Issues section below.

The Ministry observed that additional water licences, not included in Hydro's application, will be required during the project's construction phase. The Ministry suggested that if an Energy Project Certificate is issued for Site C, it require that the Ministry issue these licences as they become identified.

2.3 The Issues

Most of the issues arising out of the Water Licence can be considered in the context of the conditions attached to the draft Water Licence prepared by the Ministry.

2.3.1 Date of Precedence

Subparagraph (c) in the draft Water Licence provided that:

> The date from which this Licence shall have precedence is 30 December, 1980 subject to Clause (k) hereof.

Subparagraph (k) provided that Hydro's Water Licence will be deemed to be subsequent to any licence issued for the consumptive use of water. These two conditions together would give Hydro priority over all Water Licences applied for after December 30, 1980, except for applications for licences for the consumptive use of water. The Ministry chose December 30, 1980 as the precedure date because Hydro applied for its Water Licence on that date. No party took serious issue with this date.

2.3.2 Date of Commencement and Completion of Construction

Subparagraph (i) of the draft Water Licence provided that:

> Construction of the said work shall be commenced on or before ______ and shall be completed and the water beneficially used by ____________ or any such other date as may be directed by the Comptroller of Water Rights.

The Ministry indicated that the purpose of this provision is to ensure that construction is not dragged out and operation of the dam is not delayed, with consequent loss of water rental fees (44:7,050). No evidence was presented relating to how the power vested in the Comptroller of Water Rights would be reconciled with the provisions of the Energy Project Certificate governing construction.

2.3.3 Notification and Approval of Commencement of Construction

Subparagraph (j) of the draft Water Licences provided that:

> The Licencee shall not commence construction of the authorized works, or the portions thereof until plans for same have been submitted to the Comptroller of Water Rights and approved by him in writing.

The purpose of this provision is to allow the Comptroller of Water Rights to maintain his ongoing review and monitoring of project design and safety (43:6,900-6,902). Hydro did not take issue with this provision.

2.3.4 Water Levels

Subparagraph (l) of the Water Licence provided that:

> the normal full pool elevation of the dam is 461.8 metres (1515 feet) and may fluctuate below this level by __________ metres.

The Ministry suggested this provision in order to place a restriction on the allowable amount of drawdown in the reservoir. No upper limit was prescribed because Hydro proposed to operate the reservoir as a run-of-the-river facility as opposed to a storage facility. Thus the normal full pool elevation will not rise above 461.8 metres.

Hydro indicated that while the one thousand year flood[1] could be passed by the spillway without exceeding the 461.8 meter pool elevation, the operating instructions at the spillway would be to allow the reservoir to rise about 0.6 metres under severe floods and for the thousand year flood by as much as 1.5 metres. While no final upper limit has been determined, Hydro indicated that the worst recorded flood, which occurred in 1948, would have resulted in water levels of 462.4 metres at Site C (40:6,465).

Respecting the lower pool elevation limit, Hydro indicated that the reservoir level would drop only as much as 0.6 metres below normal pool elevation 10% of the time and would never drop more than 0.8 metres, unless there were an emergency in the system.

2.3.5 Warning System for Sudden Changes in Water Levels

Subparagraph (m) of the conditions to the draft Water Licence provided that:

> The licencee shall as directed by the Comptroller of Water Rights, establish and maintain a warning system to alert the public to sudden changes of water level occasioned by operation of the works.

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[1] One thousand year flood refers to a hypothetical flood the size of which has been statistically estimated to occur once every thousand years.

The purpose of this condition is to warn the public about deliberately-induced water level fluctuations. The Ministry indicated during cross-examination that it had no inherent objection to this provision being expanded to include a warning system for major natural fluctuations that Hydro can predict in advance. Hydro concurred in this but indicated that the final warning system had not yet been designed and should be designed only once the operating characteristics of Site C have been learned from actual experience. In this way, post-flooding reservoir conditions, particularly bank stability, could be taken into account in the design of the warning system (41:6,734-6,737).

2.3.6 Clearing

Subparagraph (n) of the draft Water Licence provided that:

> The Licencee shall clear the land to be flooded by the reservoir as directed by the Comptroller of Water Rights in consultation with the Ministry of Forests.

The Ministry did not give direct evidence regarding this condition. Chapter XIV, Sections 3.1 and 3.3, address the evidence on clearing presented by Hydro and the Ministry of Forests.

2.3.7 Clean Up of Debris

Subparagraph (o) of the draft Water Licence provided that:

> The Licencee shall endeavour to maintain the lake created by the dam free of debris.

Hydro indicated that it would undertake an intensive clean-up program in the initial period after flooding and conduct annual clean-up of the reservoir annually thereafter to ensure that the reservoir's use was not materially affected by debris floating on the surface. The Ministry led no evidence respecting this matter but numerous intervenors expressed doubts about the feasibility of maintaining the reservoir clear enough of debris to render it safe and suitable for recreation. The Williston experience was cited although Hydro testified that preclearing of that reservoir had not been undertaken, but would be at Site C.

2.3.8 Water Flows

Subparagraph (p) of the draft Water Licence provided that:

> The Licencee shall not cause the instantaneous flow in the Peace River at Taylor to be less than ________ unless otherwise authorized by the Comptroller of Water Rights.

While downstream water flows were the concern of a number of intervenors, none of the evidence presented related directly to the appropriate minimum flow at Taylor. The evidence did indicate that the Water Licence for the Bennett Dam currently provides for a minimum flow at Taylor, although it is extremely rare for flows to fall to this level.

2.4 The Commission's Position

THE COMMISSION RECOMMENDS THAT, IF HYDRO IS ISSUED AN ENERGY PROJECT CERTIFICATE, IT ALSO BE ISSUED A WATER LICENCE AND THAT THE LICENCE CONTAIN THE KINDS OF CONDITIONS SUGGESTED BY THE MINISTRY OF ENVIRONMENT. *The Commission concurs with the Ministry's suggestion that the Energy Project Certificate require the Comptroller of Water Rights to issue whatever additional licences are required during construction for water uses necessarily incidental to the construction of the facility.*

2.4.1 Date of Precedence

The Commission's conclusions and recommendations regarding specific conditions to be contained in the Water Licence are as follows: Subparagraph (c), which deals with the precedence date of the Water Licence, is appropriate if Site C proceeds. Although Site C will not be in operation for some time, other parties have had formal notice of Hydro's intention since it applied for its Water Licence. THE COMMISSION THEREFORE RECOMMENDS THAT HYDRO'S RIGHTS BE BASED ON THE DATE OF THAT APPLICATION.

2.4.2 Date of Commencement and Completion of Construction

Subparagraph (i) leaves the timing of construction to the discretion of the Comptroller of Water Rights. The Commission believes the Comptroller should not have such discretion since the project in question has already been the subject of a comprehensive hearing. THEREFORE, THE COMMISSION RECOMMENDS THAT A TIMING PROVISION BE A CONDITION OF THE ENERGY PROJECT CERTIFICATE, NOT THE WATER LICENCE.

2.4.3 Notification and Approval of Commencement of Construction

Subparagraph (j) requires that the final design be approved by the Comptroller before construction begins. This is a standard term of a Water Licence, consistent with the Comptroller's mandate under the Water Act. SINCE HYDRO'S PRELIMINARY DESIGN HAS BEEN SUBJECTED TO EXHAUSTIVE SCRUTINY THROUGH THE HEARING PROCESS, THE COMMISSION RECOMMENDS THAT THE WATER LICENCE, WHEN ISSUED, CONTAIN A PROVISION SIMILAR TO SUBPARAGRAPH (j) RELATING TO APPROVAL OF THE FINAL DESIGN. THE COMMISSION FURTHER RECOMMENDS THAT IN CONDUCTING HIS REVIEW, THE COMPTROLLER LIMIT HIS EXAMINATION OF THE FINAL DESIGN, PARTICULARLY FOCUSING ON ANY DEPARTURES FROM THE PRELIMINARY DESIGN SUBMITTED BY HYDRO AND NOT CONDUCT A SEPARATE ASSESSMENT OF THE PRELIMINARY DESIGN PRESENTED AT THESE HEARINGS.

2.4.4 Water Levels

Regarding subparagraph (1), the Commission concludes that the Water Licence should contain a provision governing maximum fluctuations above normal full pool elevation to provide more certainty for shoreline users regarding water levels. Based on the evidence, the Commission concludes that almost all reasonably anticipated conditions can be accommodated within a maximum pool elevation of 462.4 metres. To deal with unanticipated extreme conditions, the Comptroller should maintain the discretion to allow higher water levels where unavoidable.

Regarding minimum reservoir levels, the Commission concludes that the Water Licence should provide for drawdown of up to 0.8 metres at Hydro's discretion, but any further drawdown should require the approval of the Comptroller of Water Rights.

2.4.5 Warning System for Sudden Changes in Water Levels, Clearing and Clean-up

The Commission concludes that details of a warning system should be left until the characteristics of the reservoir are known. However, the Commission can identify two important features which such a system should provide. It should provide for posting of areas which are made particularly dangerous by sudden changes in water flows. It also should be closely coordinated with the bank stability monitoring which will be conducted by Hydro as described in Chapters XI and XV. In this way, the areas precluded from public use for safety reasons can be minimized while at the same time, the safe use of the reservoir and the river downstream can be ensured.

THE COMMISSION RECOMMENDS THAT ADMINISTRATION OF THIS WARNING SYSTEM BE THE RESPONSIBILITY OF HYDRO SUBJECT TO THE DIRECTION OF THE COMPTROLLER.

The Commission concludes that subparagraphs(n) and (o) should be deleted from the Water Licence. The Commission futher concludes that subparagraph(m) is appropriate subject to an amendment to require Hydro to warn of all significant anticipated changes of water level however caused. Multidisciplinary or multidepartmental issues, such as clearing standards for the reservoir and debris collection after flooding, can best be dealt with through the conditions in the Energy Project Certificate. The Commission's recommendations regarding the appropriate provisions are found in Chapter XIV in Section 7.2.

2.4.6 Water Flows

Regarding subparagraph(p) which concerns water flows at Taylor, the Commission concludes that operation of the Bennett Dam, not the Site C Dam, will continue to control water levels at Taylor during normal operating conditions. Hydro testified that it could at all times operate Site C within the minimum flow limitations imposed on it by the Water Licence for the Bennett Dam. Accordingly, the Commission concludes that the Site C Licence should simply require the same flows as the Water Licence for the Bennett Dam.

The Commission concludes that all other parts of the draft Water Licence submitted by the Comptroller are reasonable and appropriate. THE COMMISSION RECOMMENDS THAT THE COMPTROLLER OF WATER RIGHTS ISSUE A WATER LICENCE REFLECTING THE MINISTRY'S DRAFT AS AMENDED IN THE FOREGOING AND INCLUDED IN THIS REPORT AS APPENDIX 9.

3.0 THE POLLUTION CONTROL ACT AND WASTE MANAGEMENT ACT

The Waste Management Act repealed and replaced the Pollution Control Act. Like its predecessor, the Waste Management Act governs all waste disposal and pollution in the province by providing for a system of prohibitions and permits under the control of Crown managers, and ultimately the Minister of the Environment. In the context of Site C, permits would be required for various types of activities undertaken during construction of both the dam and the transmission line.

3.1 Hydro's Position

Hydro contended that the activities requiring permits under the Pollution Control Act were too numerous and site specific to allow precise identification at this time. Hydro made no comment regarding the Waste Management Act.

3.2 The Issues

No evidence was presented on the specific permits that would be required under the Waste Management Act. The general question to be addressed, however, is how the permits under the Waste Management Act should be administered as the specific requirements are identified.

The Commission concludes that it is not possible at this time to identify the precise nature of construction-related activities that might require permits under the Waste Management Act. THE COMMISSION THEREFORE RECOMMENDS THAT CABINET DIRECT THE MINISTER OF ENVIRONMENT AND, THROUGH HIM, MANAGERS UNDER THE WASTE MANAGEMENT ACT TO ISSUE SUCH PERMITS AS HYDRO SHALL REQUIRE FOR THE CONSTRUCTION OF SITE C AND ITS ASSOCIATED WORKS AND UNDERTAKINGS, PROVIDED THAT HYDRO DEMONSTRATES THAT IT WILL EMPLOY THE TECHNIQUES AND METHODS MOST LIKELY TO MINIMIZE POLLUTION.

4.0 AGRICULTURAL LAND COMMISSION ACT, RSBC 1979, C. 9

Much of the land to be flooded as a result of Site C is currently in the Agricultural Land Reserve as defined in the Agricultural Land Commission Act. Some of this land is currently owned by Hydro, some of it is privately owned and some is held by the Crown. Section 15 (2) of the Agricultural Land

Commission Act prohibits land within a reserve from being used for anything other than farming. So long as the reserve remains therefore, it bars absolutely any hydroelectric development at Site C. Section 11 of the Agricultural Land Commission Act permits Cabinet to exclude land from the reserve.

Extensive evidence was presented during these hearings relating to the agricultural potential of the Site C lands and their place in the province's agricultural industry. The Commission concludes that further hearings on the question of agricultural use are not warranted. THE COMMISSION THEREFORE RECOMMENDS THAT CABINET OF ITS OWN MOTION EXCLUDE THE AFFECTED LAND FROM THE RESERVE IF AND WHEN IT ISSUES AN ENERGY PROJECT CERTIFICATE FOR SITE C.

CHAPTER XX OTHER MATTERS

1.0 INTRODUCTION

The terms of reference directed the Commission to hear and consider -

> ... any other issues deemed by the Commission to be relevant to its review of the Application, including matters related to the issuance of a Certificate of Public Convenience and Necessity.

This chapter presents the evidence and submissions and the Commission's conclusions on the issuance of a Certificate of Public Convenience and Necessity and on other matters not dealt with in earlier chapters.

2.0 CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY

Section 51(1) of the Utilities Commission Act prohibits construction of public utility plant or system by anyone who has not first obtained a Certificate of Public Convenience and Necessity. Since Site C and its associated transmission lines fall within the definition of a public utility plant or system, Hydro requires a Certificate of Public Convenience and Necessity before starting construction.

Section 51(7) of the Utilities Commission Act provides -

> Where an Energy Project Certificate is issued to a public utility in respect of a regulated project, a Certificate of Public Convenience and Necessity authorizing the construction of the project shall be deemed to have been issued under this Section.

Thus, issuance of an Energy Project Certificate will amount to issuance of a Certificate of Public Convenience and Necessity.

It was in part in recognition of Hydro's status as a public utility that the Commission has concluded that an Energy Project Certificate should not be issued for Site C until the justification conditions outlined in Chapter X have been met, specifically, (1) that Hydro demonstrate that future electricity requirements warrant immediate commencement of construction and (2) that a comparison of system expansion alternatives indicates that Site C is the best available project. If and when such conditions are satisfied, Site C will indeed be necessary and it will be entirely appropriate for Hydro to be given a Certificate of Public Convenience and Necessity.

3.0 PROVINCIAL ENERGY POLICY

The Site C terms of reference do not ask the Commission to make recommendations on provincial energy policies. Rather, they refer the Commission to the existing policy framework outlined in the Province's Energy Policy Statement of February, 1980.

During the course of the hearings, however, a number of issues were raised with respect to provincial energy policy, which the Commission wishes to bring to the attention of the government for its on-going policy review.

3.1 Energy Pricing Policy

The Commission has concluded in Chapter VII that energy prices have an important effect on future energy demand. Policy governing energy prices is therefore a critical factor underlying the need for new supply.

The provincial energy policy statement of February 1980 states that "the price of energy commodities must continue to be adjusted to reflect long-term replacement costs and the value of the resource." However, no evidence was presented at the hearings by the Ministry of Energy, Mines and Petroleum Resources as to what that statement specifically means for electricity prices in B.C. For this review the Commission therefore had to assume no departure from traditional rate setting procedures for its review.

To facilitate future reviews, specific policy direction or decisions are required with respect to the following questions:

- If electricity prices are to be based on long-term replacement costs, how are such costs to be defined?
- To what extent will social, particularly social costs of capital, as opposed to private costs be taken into account in long-term replacement costs?
- Over what time period does the government intend this pricing policy to be implemented?
- To what extent will water rentals be related to long-term replacement cost of electricity or used as a means of implementing replacement cost pricing; specifically, how will water rentals be determined?

With such policy direction, more meaningful price forecasts can be made and taken into account in the forecasts of future electricity load requirements.

3.2 The Role of Government and Hydro in Forecasting Future Load Growth and Requirements

For a number of years the government or its agencies have prepared energy requirements forecasts that have differed from Hydro's. The question therefore arose as to which forecast Hydro should be directed to meet, the government's or its own. To deal with the problem, some participants proposed creation of a separate government planning body part of whose role would be energy forecasting. Others raised the possibility of closer liason between Hydro and the government to reconcile or develop a common forecast.

The Commission concludes that Hydro must continue to develop its plans on the basis of its own best forecast, since any other approach would inappropriately detract from its independence and integrity. However, Hydro's forecasts should continue to be scrutinized by public review in order to assess their validity and reliability, taking into account information made available by others including the provincial government.

WITH RESPECT TO FORECASTS MADE BY HYDRO AND THE MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES, THE COMMISSION RECOMMENDS THAT STEPS BE TAKEN TO EMPLOY A COMMON DATA BASE WHEREVER POSSIBLE, AND COMMON DEFINITIONS OF SECTORS AND YEARS. Hydro's and the Ministry's forecasts may continue to differ, but at least the underlying reasons would become more clear.

3.3 Electricity Export Policy

Both Hydro witnesses and the Minister of Energy, Mines and Petroluem Resources enunciated the existing government policy regarding electricity exports; namely, that facilities are not constructed for the purpose of exporting electrical energy. Exports do occur, but mainly as a result of the availablility of non-firm hydroelectric energy or as a result of inadvertent excess supply. With respect to justification of the Site C project the Commission has assumed this policy.

Hydro implicitly considers the potential for surplus spot sales in evaluating the appropriate timing of new supply aimed at meeting domestic requirements. As described in Chapter VIII, surplus export market conditions have a major bearing on the consequences and costs of excess supply, and therefore on the logic or prudence of Hydro's planning criteria.

THE COMMISSION RECOMMENDS THAT MORE EXPLICIT CONSIDERATION OF SURPLUS SALES PROSPECTS BE INCORPORATED INTO SYSTEM PLAN EVALUATIONS.

THE COMMISSION FURTHER RECOMMENDS THAT THE POTENTIAL FOR FIRM SALES OF SHORT OR INTERMEDIATE TERMS BE CONSIDERED IN EVALUATING THE PREBUILDING OF NEW FACILITIES AND PARTIALLY AMORTIZING THEIR COSTS WITH EXPORT REVENUES. This is currently precluded by provincial policy and has not been considered in this review. The Commission recognizes that such a change in policy would result in facilities being built earlier than required by domestic load. Clearly, such an approach may have economic merit, if not in the present circumstances, then possibly in the future.

THE COMMISSION ALSO RECOMMENDS THAT THE POTENTIAL FOR FIRM SALES WITH LONG-TERM CONTRACTS BE CONSIDERED IN EVALUATING THE MERITS OF DEDICATING A PART OF A NEW FACILITY TO THE EXPORT MARKET. Provided all social costs are properly taken into account and that future domestic needs are protected, such sales could be advantageous to the province.

3.4 Development Policy

The evidence showed clearly that a major difficulty Hydro faces in developing load growth forecasts and hence system plans is in estimating future new industrial loads. On the one hand, Hydro feels obligated to make provisions for such loads so that electricity supply does not constrain new economic development. On the other hand, since these loads are not committed, it is not clear to what extent they should be taken into account since new facilities might be built in anticipation of loads that never materialize.

This problem relates directly to provincial industrial policy and the extent to which the province wishes to encourage the development of electricity-intensive industry and to gear Hydro's planning to accommodate such development whenever it occurs.

THE COMMISSION HAS NO RECOMMENDATIONS ON GOVERNMENT POLICY IN THESE MATTERS. THE COMMISSION RECOMMENDS, HOWEVER, THAT GOVERNMENT POLICY WITH RESPECT TO BOTH THE TYPE OF INDUSTRIAL DEVELOPMENT IT IS SEEKING AND THE ROLE OF HYDRO IN FACILITATING ITS DEVELOPMENT SHOULD BE CLARIFIED TO ASSIST HYDRO IN DEVELOPING ITS PLANS, AND ALSO TO ASSIST FUTURE COMMISSION PANELS IN ASSESSING THE NEED FOR NEW SUPPLY.

4.0 OTHER MATTERS

Various matters and issues were raised at the hearings that did not fall directly under any specific heading of the terms of reference or that have not been fully addressed in other parts of this report. The most important of these issues are considered in the balance of this chapter.

4.1 Future Land Acquisition and Disposition Policy

Hydro's evidence on land acquisition was discussed in detail in Chapter XIV. In summary, Hydro indicated that it had undertaken a passive land acquisition program until the Utilities Commission Act was passed in 1980. Since then, it had neither acquired nor disposed of land and it did not intend to do so until its Energy Project Certificate Application had been disposed of. Hydro did not indicate what its policy regarding land acquisition or disposition would be if the project were deferred significantly.

Regarding the amount of land ultimately required for the project, Hydro indicated that it employed a conservative approach to ensure that it controlled all land needed to operate the reservoir safely plus all the private land that might be unstable after reservoir filling. To this end, Hydro has acquired or intends to acquire all private land between the present river bank and the safe line. Hydro agreed that this policy could result in its owning or controlling more land than ultimately required, but emphasized the importance of erring on the side of safety.

Hydro also indicated that it would dispose of lands no longer required either because the project is abandoned or because post-project bank monitoring indicates the land is stable. With this in mind, Hydro entered into a buy-back agreement with some of those whose land it had already acquired under which the original owner had a right of first refusal on lands Hydro no longer required.

Hydro's past policy on land acquisition was criticized by a number of intervenors. The nature of these criticisms varied, but most felt that they had been treated unfairly. None addressed the question of what should be done respecting land acquisition if the project is deferred significantly.

Some intervenors criticized Hydro's approach to determining the project's land requirements. They suggested that Hydro's existing and proposed acquisitions between the full supply level and the safe line were excessive and needlessly disrupted the operations of existing landowners.

The Commission has concluded in Chapter X that the Site C project should be deferred. The Commission does not wish the uncertainty caused by that deferral to prejudice residents of the region any more than is absolutely necessary. FOR THIS REASON, THE COMMISSION RECOMMENDS THAT HYDRO REINSTITUTE ITS PASSIVE LAND ACQUISITION PROGRAM UNTIL AN ENERGY PROJECT CERTIFICATE IS ISSUED. The application of this program must be consistent and even handed and must simply amount to a public declaration that Hydro is willing to pay fair market value for any land that current owners wish to sell. In this way, a market will exist for those who wish to sell but those who wish to hold on as long as possible can do so.

THE COMMISSION CONCLUDES THAT HYDRO IS IN THE BEST POSITION TO DETERMINE WHAT LAND WILL, IN FACT, BE REQUIRED FOR THE PROJECT, BUT RECOMMENDS THAT HYDRO MAKE EVERY EFFORT TO MINIMIZE THE DISRUPTION CAUSED BY THE PROJECT BY ACQUIRING

AS LITTLE LAND AS POSSIBLE. THE COMMISSION RECOMMENDS THAT HYDRO ACQUIRE INTERESTS THAT FALL SHORT OF OUTRIGHT ACQUISITION, SUCH AS EASEMENTS, WHEREVER POSSIBLE SO AS TO ALLOW CURRENT LAND USE TO CONTINUE TO THE MAXIMUM EXTENT POSSIBLE. OUTRIGHT PURCHASE AGAINST THE EXISTING OWNER'S WISHES SHOULD ALWAYS BE A LAST RESORT.

FINALLY, THE COMMISSION RECOMMENDS THAT HYDRO INCLUDE A BUY-BACK PROVISION FOR ANY FUTURE PRIVATE PROPERTY ACQUISITIONS AND ALSO OFFERS THE SAME PROVISION TO PAST VENDORS AT SITE C WHERE THIS HAS NOT BEEN DONE. Such a provision allows the original land owner to re-acquire his land if it is not required for the project. This will be of particular importance when only part of his land was purchased in the first place.

4.2 Data Requirements

Hydro took the position throughout the hearings that it had provided sufficient information in all areas to allow the Commission to determine whether the Site C project is in the public interest and, if it is, under what conditions it should proceed. Hydro acknowledged information gaps in some areas but maintained that the information it had provided was sufficient for this hearing.

Numerous intervenors argued that Hydro was obligated to provide all the information reasonably obtainable to give as sound a basis as possible for predicting the impacts of the project. They argued that Hydro had failed to do this in many areas. Some Ministries of the provincial government concurred in this view. In several instances, however, the Ministries did not formally advise Hydro that they perceived data deficiencies until they filed their submissions to the Site C hearing in November of 1981.

The Commission believes that the applicant is ultimately responsible for providing sufficient information to allow the Commission to make an informed decision regarding the issues raised by its terms of reference. The Commission has found the evidence produced by Hydro in support of its application to be wanting in several significant respects and has made recommendations designed to remedy these deficiencies.

The Commission is confident that much of the information Hydro has failed to produce can be provided to the satisfaction of Cabinet through cooperation between Hydro and the appropriate Ministries of government. In these areas, the Commission urges as full an exchange of information as possible.

The Commission believes that a dialogue of the sort recommended could and should have occurred long before the Site C hearings began. In particular, time could have been saved if, before the hearing began Hydro and the Ministry of Agriculture and Food had resolved their dispute on the amount and classification of agricultural land that would be lost to the project.

The Commission strongly endorses public consultation as an integral part of the energy project review process in the province. The Commission encourages government Ministries, applicants and other interested parties to make fuller use of it in the future. If all parties work together to identify the major issues in advance of the hearings, the quality of evidence adduced by the applicant and intervenors can be expected to be improved and less time spent exploring areas ultimately determined to be of little consequence.

4.3 Equity Considerations

The Guidelines for Benefit-Cost Analysis make explicit reference to equity considerations in the discussion of appropriate levels of compensation. The principle, when applied to a project such as Site C, recognizes that those individuals and communities upon whom the costs of the project are imposed may not be the ones who benefit the most. Thus, while the project may be in the interests of the province as a whole, it may have adverse consequences for particular groups or individuals.

The Commission has concluded that Site C, built at the appropriate time, can be in the best interests of the province even though it may not be in the best interests of some individuals. The compensation payments recommended in this report are in part designed to redress this imbalance and to be successful they must reach the affected groups.

The Commission has recommended that various compensation payments be paid directly to the account of particular Ministries. The Commission is aware that in practice, the payments will simply be made by Hydro to the province's general account. It is therefore important that individual Ministers ensure that the monies, once paid into general revenue, find their way into the appropriate departments and into the appropriate regions. If the recommendations in this report are to result in an equitable distribution of the costs and benefits of Site C, the enhancement programs and compensation payments recommended in this report must be undertaken and made for the benefit of the citizens of the Peace River area.

4.4 Cumulative Impacts

A number of intervenors, expressed concern about the cumulative impacts of developments and they criticized what they viewed as a piecemeal approach to development of the Peace River, which has increased those impacts. The cumulative impact of unrelated projects in frontier areas is well beyond the scope of this report. However, the Commission is concerned about the cumulative impacts of hydro development on a particular river basin.

The Commission concludes that where development of an entire river system is anticipated, it should only be undertaken after the impact of full development has been considered. In the case of the Peace River Basin and Site C, much of the development has already occurred and consequently only an incremental approach is possible.

In the context of Hydro's northern river developments however, a cumulative analysis is still possible. THE COMMISSION RECOMMENDS THAT ANY INQUIRY INTO THOSE RIVER BASINS SHOULD LOOK AT THE IMPACT OF THE ENTIRE DEVELOPMENT OF EACH BASIN AND NOT JUST THE FIRST STEP OF THE DEVELOPMENT.

4.5 Onsite Power

A number of intervenors sought to raise the question of preferential rates for onsite power as an issue during the hearings. On July 13, 1982, the Commission ruled that this issue was outside its terms of reference and no recommendation would be made concerning it.

The Commission notes that preferential pricing of power in communities affected by a major energy project could appear to be an attractive form of compensation to those communities. The Commission concludes, however, that regional impacts can best be managed by compensation and mitigation programs such as those recommended in this report.

This is the majority report of the Site C Division of the British Columbia Utilities Commission, dated May 3, 1983, in response to the Lieutenant Governor's Order-in-Council Number 961 approved and ordered April 23, 1981.

DATED at the City of Vancouver, in the Province of British Columbia, this 3rd day of May, 1983.

Keith Henry

KEITH A. HENRY, P. Eng.
Commissioner and Chairman

Earl E. Little

EARL E. LITTLE, P. Eng.
Commissioner

ROBERT A. PETRICK
Commissioner

Lorne E. Ryan

LORNE E. RYAN, P. Eng.
Commissioner

DISSENT BY COMMISSIONER D.B. KILPATRICK

The position of the Site C Division of the B.C. Utilities Commission with respect to justification of the project has been summarized on page 125 in Chapter X of the Site C Report as follows:

> "On the basis of the evidence, however, the Commission is not satisfied that Hydro has demonstrated that a 1983 start-up date is justified or that Site C is the only possible source to follow Revelstoke in the system plant, or that it is preferable to all other sources."

These conclusions, which I fully support, clearly indicate that, in the judgment of the Commission, B.C. Hydro has failed to meet the three most fundamental and essential requirements for approval of an Energy Project Certificate.

Under the circumstances, I do not concur with the majority recommendation of the Site C Division that the issuance of an Energy Project Certificate be merely deferred until the essential evidence is provided by the Applicant.

In my opinion, rejection of an Application is the only appropriate result where crucial evidence is missing. To simply defer issuing the required Certificate in such circumstances will not provide sufficient incentive to the Applicant to provide adequate evidence in future applications, or to refrain from applying for the Certificate until the circumstances warrant the application.

Rejection of the present Application for cause need not be viewed or treated as unusual or unexpected, since it flows directly from the unanimous conclusions of the Commission on the evidence presented. The Applicant is free to re-apply under terms of reference which can be confined to the missing evidence, the evidence on all other issues having already been heard and accepted by the Commission as both useful and adequate for a final decision.

For the foregoing reasons, I therefore dissent from the majority recommendation of the Site C Division of the Commission and submit my personal recommendations as follows:

1. That the Site C Application by B.C. Hydro in its present state be rejected.

2. That the Applicant be invited by the Government to re-apply when justified by new evidence confined entirely to:

    (a) Demand/supply - magnitude of need and project timing.

    (b) System Planning studies confirming Site C as first choice.

3. That the new evidence be referred to and reviewed by the B.C. Utilities Commission in an abbreviated public hearing, under terms of reference confined to the foregoing, and that the appropriate recommendations be directed to the Lieutenant Governor-in-Council, as prescribed by the Act.

In all other respects, I concur with the findings, conclusions and recommendations contained in the Site C report.

D. B. Kilpatrick

D. B. Kilpatrick
Commissioner

May 3, 1983

GLOSSARY

TERMS

Base Load	The level of electrical energy demand which occurs at off-peak as well as peak periods.
Cabinet/Lieutenant Governor-in-Council	These two terms have been used interchangably in this report. Pursuant to Section 21 of the Utilities Commission Act, the Lieutenant Governor-in-Council has the authority to issue an Energy Project Certificate and to attach to it any conditions which he considers to be in the public interest.
Credit Ratings	A system of rating securities used to indicate investment security. There are nine symbols as shown below, with the first indicating highest investment security and the last indicating lowest investment security: Aaa Aa A Baa Ba B Caa Ca C.
Compensation for Environmental and Social Impacts	Payments, in cash or in kind, which are made by developers or parties responsible for the impacts, with the objective of redressing or offsetting the losses which occur despite or in lieu of mitigation.
Consumer Surplus	The value that individuals attach to a particular good, service or opportunity less the amount they actually pay for it.
Critical Water Years	A series of low water years defined in the B.C. Hydro system by the period September 1942 to April 1946.
Cross Elasticity of Demand	The ratio of the percentage change of the demand for one commodity (or input) to a given percentage change of the price of a different commodity (or input).
Discount Rate	The rate at which future values are reduced to comparable present value.

Drawdown	The lowering of the water level of a reservoir by spilling or otherwise withdrawing more water from it than is coming in.
Firm Hydroelectric Capability	The annual amount of hydroelectric energy that can be produced by B.C. Hydro's system while in a critical water year sequence.
Full Supply Level	The elevation of the water surface in a reservoir when it is full.
Geothermal Energy	Heat produced by natural processes such as hot springs and geysers.
Gross Provincial Domestic Product (GPDP)	The total value added of all final goods and services produced in a province in a given period of time (usually measured yearly).
Interest Coverage Ratio	The ratio between the funds available to service debt (revenue less expenses) and interest costs.
Income Elasticity of Demand	The ratio of the percentage of change of the demand for a particular commodity to a given percentage change of income.
Mitigation of Environmental and Social Impacts	Measures taken in the design, construction or operation of a project specifically aimed at reducing adverse impacts.
Morphoedaphic Index	An index which is a function of the mean depth and total dissolved solids in a water body (usually a lake) used to predict potential fish yields.
Overburden Bank	The portion of riverbank formed by clays, silts, sands or gravels or any mixture of them.
Penstock Encasement	The concrete protective cover over a steel penstock.

Petajoule	One quadrillion or 1×10^{15} joules, a measure of energy equal to 277.8 gigawatt hours (GWh) or 277.8 million kilowatt hours (KWh).
Pot Lines	The electrical furnaces used in refining aluminum.
Price Elasticity of Demand (or Own Price Elasticity)	The ratio of the percentage change in the demand for a particular commodity to a given percentage change in its price.
Rebound	The expansion of a foundation material which has been compressed by a mass of overlying material when the overlying material is removed.
Resource Economic Rent	The value of production made possible by a resource, less the costs of all the inputs to production other than the costs of that resource itself.
Retrofitting	The installation of new facilities or equipment to existing plants or structures.
Ryder's Equation	A statistically derived formula used for estimating potential fish yields utilizing the morphoedaphic index.
Safeline	A line on the banks of a reservoir above or outside of which is considered safe from bank sliding or sloughing.
Site C and Site E Flood Reserves	The Lieutenant Governor-in-Council may for any purpose that he considers to be in the public interest reserves Crown land from disposition and has done so for large areas which would be flooded if Site C or Site E are to be constructed. Once established these reserves may be cancelled in whole or in part by the Lieutenant Governor-in-Council.
Sloughing	Relatively gradual erosion and subsidence of an overburden bank as it adjusts to a new water level regime.

Social Benefit-Cost Analysis	A method of evaluating alternative investments or projects from society's point of view.
Social Opportunity Cost of Capital	The pre-tax rate of return of capital obtainable in its best alternative use.
Social Time Preference Rate	The rate which measures society's preference for present consumption versus saving (future consumption).
Spillway	A device by which significant quantities of water can be spilled from a reservoir without going through the generators.
Stilling Basin	A basin or pool of water at the lower end of a spillway where the kinetic energy of the falling water is dissipated under conditions controlled to prevent erosion.
Subsidence	Sinking
Surplus Electrical Energy	Hydroelectric energy available when greater than critical water conditions prevail, plus firm energy not required to meet domestic or export load.
System	The generation, transmission and distribution facilities of an electrical utility.
System Expansion Plan	The plan describing the increase in generation, transmission and distribution facilities to allow the production and use of more electrical energy.
Thermal Energy	Energy produced from heat, usually from the burning of fossil fuels, (oil, coal, gas) or by nuclear reactors.
Thousand Year Flood	A hypothetical flood the size of which has been statistically estimated to occur once every thousand years.
Willingness-to-be-Compensated	The amount of compensation needed to induce individuals to forego the use of a particular good or service.
Willingness-to-Pay	The price that individuals would be willing to pay for a particular good or service.

UNITS USED IN THE SITE C REPORT

The system of units called SI, or systeme internationale, has a series of abbreviations, most of which, but not all, are single letters, either lower case or capitals. Some basic units and their abbreviations are:

volt	V	metre	m
watt	W	grams	g
joule	J	ampere	A
hour	h	liter	L

These basic units can be combined to obtain derived units such as:

watt hour	Wh

In order to handle larger and small quantities, a number of prefixes are used to indicate that the basic or derived unit is to be multiplied or divided by a number such as ten or a thousand or a trillion. For example,

milli	m	divide by 1,000		10^{-3}
centi	c	divide by 100		10^{-2}
deca	da	multiply by 10		10
kilo	k	multiply by 1,000	one thousand	10^{3}
mega	M	multiply by 1,000,000	one million	10^{6}
giga	G	multiply by 1,000,000,000	one billion	10^{9}
peta	P	multiply by 1,000,000,000,000	one quadrillion	10^{15}

Using these prefixes with the basic and derived units, the two dozen or so expressions used most commonly can be written:

volt	V	kilovolt	kV	kilowatt hour	kWh
watt	W	kilowatt	kW	gigawatt hour	GWh
		megawatt	MW		
joule	J	petajoule	PJ		
metre	m	centimetre	cm	millimetre	mm
		kilometre	km	kilogram	kg
gram	g	milligram	mg		

In order to cope with areas and volumes it is necessary to use indices to indicate, for instance:

square metres	m^2	hectare	ha	is 10,000 m^2
cubic metres	m^3			

Number/
Numéro

2

BRITISH COLUMBIA UTILITIES COMMISSION

SITE C REPORT

IN THE MATTER OF
THE UTILITIES COMMISSION ACT
S.B.C. 1980, c.60 as Amended

AND

IN THE MATTER OF THE APPLICATION OF
BRITISH COLUMBIA HYDRO AND POWER AUTHORITY
FOR AN ENERGY PROJECT CERTIFICATE FOR THE
PEACE RIVER SITE C PROJECT

REPORT & RECOMMENDATIONS
to the
LIEUTENANT GOVERNOR-IN-COUNCIL

APPENDICES

SITE C REPORT

APPENDICES

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APPENDIX 1

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

E. H. MARTIN
Executive Vice-President,
Operations

970 BURRARD STREET
VANCOUVER, B. C.
V6Z 1Y3

29 September 1980

The Honourable R. H. McClelland,
Minister of Energy, Mines and
Petroleum Resources,
Parliament Buildings,
VICTORIA, B. C.
V8V 1X4

Dear Mr. McClelland:

Attached is B. C. Hydro's Application for an Energy Project Certificate for the Peace River Site C hydroelectric project, prepared in accordance with Regulation No. 388/80.

Much of the information contained in this Application is a summary of more detailed information contained in the Environmental Impact Statement, which is enclosed as supporting material.

Yours very truly,

EH Martin

Encls.

AFFIDAVIT

IN THE MATTER of the Utilities Commission Act and of an application by British Columbia Hydro and Power Authority.

I, ERIC HENRY MARTIN, of 5769 Cranley Drive, West Vancouver, British Columbia, make oath and say as follows:

1. I am the Executive Vice-President, Operations, for the Applicant, British Columbia Hydro and Power Authority and as such am duly authorized to make this Affidavit and sign upon its behalf the application of British Columbia Hydro and Power Authority for an Energy Project Certificate under Section 18 of the Utilities Commission Act, a true copy of which is attached hereto and marked Exhibit "A" to this very Affidavit.

2. The information contained in said application regarding British Columbia Hydro and Power Authority and the particulars of the Project is to the best of my knowledge and belief, true and accurate in all respects.

3. The information contained in the said application which describes and evaluates the impacts of the proposed Site C Project is prepared from material provided by independent consultants, retained by the Applicant, and I verily believe said information accurately represents their findings and conclusions as to the effects of the project.

SWORN BEFORE ME at the City of
Vancouver, in the Province of
British Columbia, this 29th
day of September 1980.

A Commissioner for taking
Affidavits for the Province
of British Columbia

ERIC HENRY MARTIN

APPENDIX 2

BRITISH COLUMBIA

961

APPROVED AND ORDERED APR. 23.1981

Lieutenant-Governor

EXECUTIVE COUNCIL CHAMBERS, VICTORIA APR. 23.1981

On the recommendation of the undersigned, the Lieutenant-Governor, by and with the advice and consent of the Executive Council, orders that the following persons be and are hereby appointed as temporary commissioners of the British Columbia Utilities Commission for the purpose of the review of the British Columbia Hydro and Power Authority's Application for an Energy Project Certificate for the Peace Site C Generation/Transmission Project and shall be paid the renumeration opposite their names:

1.	Mr. Keith A. Henry, 1110 Millstream Road, West Vancouver, B.C.	$500.00 per diem
2.	Mr. Earl E. Little, 10407-111th Avenue Fort St. John, B.C.	$250.00 per diem
3.	Mr. Lorne E. Ryan, R.R. #2, Ganges, B.C., V0S 1E0	$250.00 per diem
4.	Mr. Robert A. Petrick, Old Hart Highway, Dawson Creek, B.C.	$250.00 per diem

AND FURTHER ORDERS THAT this appointment terminates on the day on which the British Columbia Utilities Commission submits its report and recommendations regarding the said Application to the Lieutenant Governor in Council.

Minister of Energy, Mines and
Petroleum Resources

W. R. Bennett

Presiding Member of Executive Council

(This part is for administrative purposes and is not part of the Order.)

Authority under which Order is made:

Act and section Utilities Commission Act, Section 2(6) and 4

Other (specify)

Statutory authority checked by W.B. Maddaford
(Signature and typed or printed name of Legal Officer)

April 22, 1981

1072/81/dpv

APPENDIX 3

NAMES AND BRIEF BACKGROUND OF COMMISSIONERS

KEITH A. HENRY, P. ENG.

Mr. Henry is President of C.B.A. Engineering Limited and Vice-President of Crippen Consultants. He has been involved in water resource development in Canada and around the world for thirty-five years. In addition to his work as a professional engineer on all aspects of water resource conservation and development, he served as one of Canada's three Commissioners on the International Joint Commission, Canada and the United States from 1972 to 1978. He is currently Canada's director of the International Water Resource Association, a director of the Association of Consulting Engineers of Canada, and Chairman of the Westwater Research Council of the University of British Columbia.

DONALD B. KILPATRICK

Mr. Kilpatrick is a full-time member of the B.C. Utilities Commission, to which he was appointed in September 1980 after serving from July 1977 as Commissioner of the predecessor B.C. Energy Commission. Prior to his appointment to the B.C. Energy Commission he served for 26 years in progressively senior staff positions in the forest industries of both the United States and Canada. Mr. Kilpatrick is a graduate in Civil Engineering from McGill University and was named Baker Scholar of the 1951 MBA graduating class at the Harvard Graduate School of Business Administration.

EARL E. LITTLE, P. ENG.

Mr. Little has been actively engaged in a survey and engineering practice in Fort St. John since 1957. He is a registered professional engineer in British Columbia and Alberta, a commissioned land surveyor in both provinces, and also a Canada Lands Surveyor. Mr. Little has served six years as a school trustee with one year as Chairman. He has also spent five years on the board of the Corporation of Land Surveyors of the Province of British Columbia with one year as its President.

ROBERT A. PETRICK

Mr. Petrick is a Dawson Creek businessman, having lived in the Peace River district since 1931. He is presently serving his third term as city Alderman and Regional District Director. As well, he is a Director of the B.C. Municipal Finance Authority. Mr. Petrick has served six years on the Executive of the B.C. Chamber of Commerce with one year as President. He has also served a number of years with various provincial tourist organizations, including the Provincial Tourist Advisory Board.

LORNE E. RYAN

Mr. Ryan was formerly City Manager for the City of Vancouver and is now retired. He was educated in Vancouver and is a registered professional engineer. Prior to serving as City Manager, Mr. Ryan was in charge of the city's electrical department for 15 years. Mr. Ryan served from 1939 until 1946 as an electrical officer in the merchant navy and as an executive officer in the R.C.N.V.R. Prior to the war, Mr. Ryan was employed in the electrical construction industry. He is married, with three sons and is a resident of Salt Spring Island.

IN THE MATTER OF THE UTILITIES COMMISSION ACT
S.B.C. 1980 c. 60

and

IN THE MATTER OF THE APPLICATION BY
BRITISH COLUMBIA HYDRO AND POWER AUTHORITY FOR AN
ENERGY PROJECT CERTIFICATE FOR THE
PEACE SITE C GENERATION/
TRANSMISSION PROJECT

DISPOSITION OF APPLICATION AND TERMS OF REFERENCE FOR REVIEW BY BRITISH COLUMBIA UTILITIES COMMISSION

THE MINISTER OF ENERGY, MINES AND PETROLEUM RESOURCES, with the concurrence of the MINISTER OF ENVIRONMENT, pursuant to Section 19(1)(a) of the Utilities Commission Act, hereby refers the British Columbia Hydro and Power Authority's Application for an Energy Project Certificate for the Peace Site C Generation/Transmission Project to the British Columbia Utilities Commission for review.

Pursuant to section 20 of the Utilities Commission Act and having regard for the Government of British Columbia's energy policy statement of February, 1980, the British Columbia Utilities Commission shall hear the said Application in public hearing in accordance with the following terms of reference:

1. PROJECT JUSTIFICATION

The Commission is directed to review the requirement for the project, including consideration of electricity demand forecasts relative to supply in a total energy context, and industrial development opportunities made available in the Province; the project's financial impacts on the Applicant and on electricity users; and the project's overall impact on the Province, specifically its social benefit-cost, including environmental, land use, social and economic impacts.

The Province of British Columbia's Environmental and Social Impact Compensation/Mitigation Guidelines and Guidelines for Benefit-Cost Analysis are to be used as a reference for the above review, as appropriate.

2. PROJECT DESIGN

The Commission is directed to review the adequacy and technical feasibility of the project, public works and ancillary undertakings, including consideration of design, safety and timetable in the construction and operation phases.

3. ENVIRONMENTAL, LAND USE, SOCIAL AND ECONOMIC IMPACTS

The Commission is directed to review the nature and extent of potential impacts by the project on the physical, biological, social and economic environments, and consider proposals to mitigate negative impacts and maximize benefits from positive impacts, and proposals to compensate for, or offset, unavoidable negative impacts.

Particular consideration shall be given to short and long term impacts, related mitigation and compensation proposals, and means for their implementation, regarding:

(a) local climate, including changes in humidity and air quality;

(b) hydrology, including water quantity and quality, effects on downstream users and rights of prior licensees under the Water Act;

(c) terrain resources, including mineral, hydrocarbon and aggregate resources, and land stability;

(d) agriculture, including existing and potential agricultural land and industry;

(e) outdoor recreation, including existing and potential recreational opportunities and scenic amenities;

(f) forestry, including existing and potential merchantable timber, and reservoir preparation and debris control;

(g) wildlife, including existing and potential habitats and populations, and hunting, viewing, trapping and guiding activities;

(h) fisheries, including existing and potential habitats and populations, and fishing activities;

(i) heritage sites, including known resources and areas of heritage potential;

(j) present and future land alienation, including displacement of residents, land owners and resource users, and access alterations;

(k) regional and provincial labour markets, including magnitude, composition, timing, origin and training of the project's manpower requirements, and matters related to the work environment;

(l) community and regional settlement and land use, including housing and building markets, rural land use, and local government corporate status;

(m) community and regional infrastructure, including costs and revenues for water, sewerage, road and other systems, and implications for local government finances;

(n) community and regional social services;

(o) community social structure, functioning and stability; and

(p) regional and local economies.

4. OTHER MATTERS

The Commission is directed to hear and consider:

(a) whether an approval, licence or permit should be made, given, or issued under Sections 4, 5, 7, 8, 9 or 10(4) of the Pollution Control Act and under Sections 6, 7, 10 or 11 of the Water Act, including all matters regarding the Applicant's Water Licence Application filed in accordance with the Water Act; and

(b) any other issues deemed by the Commission to be relevant to its review of the Application, including matters related to the issuance of a Certificate of Public Convenience and Necessity.

5. RECOMMENDATIONS

The Commission shall submit a report and recommendations, with supporting rationale, to the Lieutenant Governor in Council on:

(a) the refusal or issuance of the Energy Project Certificate;

(b) if issuance is recommended, any conditions in the public interest to be included in the Energy Project Certificate and the Energy Operation Certificate; and

(c) the making, giving or issuing of an approval, licence or permit under the Pollution Control Act and the Water Act, and necessary terms or conditions.

6. The following documents are referred to the British Columbia Utilities Commission:

(a) The British Columbia Hydro and Power Authority's Application for an Energy Project Certificate for the Peace Site C Generation/Transmission Project together with supporting documents;

(b) A signed copy of the British Columbia Hydro and Power Authority's Peace Site C Water Licence Application and copies of Water Licence objections filed to date.

R. H. McClelland,

Minister of Energy, Mines
and Petroleum Resources.

Stephen Rogers

S. Rogers,

Minister of Environment.

DATED THIS 23rd DAY OF
APRIL, 1981

APPENDIX 5

LIST OF PARTIES AND APPEARANCES

PARTY	APPEARANCES
A. Formal Hearings	
ARCHAEOLOGICAL SOCIETY OF B.C.	Did not appear
ASSOCIATION OF BRITISH COLUMBIA PROFESSIONAL FORESTERS	Mr. W.A. Hopwood
BLACK, Mr. J.M.	Self
B.C. CHAMBER OF COMMERCE	Mr. N.D. McLaren Mr. M.A. Thomas
B.C. FEDERATION OF AGRICULTURE	Mr. D. Knoerr Mr. J. Hoogendoorn
B.C. HYDRO AND POWER AUTHORITY	Ms. D. Barnett
B.C. INSTITUTE OF AGROLOGISTS	Mr. K. Roberts
B.C. MINISTRY OF AGRICULTURE AND FOOD	Mr. E. N. Hughes, Q.C.
B.C. MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES	Mr. E.N. Hughes, Q.C.
B.C. MINISTRY OF ENVIRONMENT	Mr. W. Pierce
B.C. MINISTRY OF FORESTS	Mr. E.N. Hughes, Q.C.
B.C. MINISTRY OF INDUSTRY AND SMALL BUSINESS DEVELOPMENT	Mr. E.N. Hughes, Q.C.
B.C. MINISTRY OF LABOUR	Mr. E.N. Hughes, Q.C.
B.C. MINISTRY OF LANDS, PARKS AND HOUSING	Mr. E.N. Hughes, Q.C.
B.C. MINISTRY OF PROVINCIAL SECRETARY AND GOVERNMENT SERVICES	Mr. E.N. Hughes, Q.C.
B.C. MINISTRY OF TRANSPORTATION and HIGHWAYS	Mr. E.N. Hughes, Q.C.

LIST OF PARTIES AND APPEARANCES
(cont'd)

PARTY	APPEARANCES
B.C. PEACE COUNTRY RIVER RATES	Did not appear
B.C. PEOPLE'S FOOD COMMISSION	Did not appear
B.C. WILDLIFE FEDERATION	Mr. R. Kenyon
B.C. UTILITIES COMMISSION	Mr. R.J. Gibbs Mr. C.W. Sanderson Mr. B. Armstrong
BROCKE, Mr. D.	Self
BROCKE, Mr. R.D.	Did not appear
BROCKE, Ms. S.	Did not appear
BROWN, Mr. C.	Did not appear
BRUMMET, Mr. A.J., M.L.A.	Self
BUTTERWORTH, Mr. E.	Self
CANADIAN OCCIDENTAL PETROLEUM LTD.	Did not appear
CHESSOR, Mr. E.	Self
CHETWYND CHAMBER OF COMMERCE	Did not appear
CHEVRON CANADA LIMITED	Did not appear
CITIZENS OF FORT ST. JOHN	Did ;not appear
COMMUNIST PARTY EXECTIVE	Mr. M. Ruch
COUNCIL OF FOREST INDUSTRIES OF B.C.	Mr. B. Wallace
CRUTIS, Mr. J.	Self
DARNELL, Ms. R.A.	Did not appear

LIST OF PARTIES AND APPEARANCES
(cont'd)

PARTY	APPEARANCES
DAWSON CREEK, CITY OF	Mr. D. Lidstone Mr. W. Woodson
DOGWOOD CANOE CLUB	Mr. D.J. Huntley
DOME PETROLEUM CO. LTD.	Did not appear
DON PECK HOLDINGS, LTD.	Mr. G. Cranston
DOWN, Mr. M.	Self
ELECTRICAL AND ELECTRONICS MANUFACTURERS ASSOCIATION OF CANADA	Mr. G.A. Vaughan Mr. D.E. Armour Mr. D.J. Turland Mr. W.N. Isberg
ENDERLIN, Mr. R.	Self
ENVIRONMENT AND ECOLOGY FOR THE LOCAL COUNCIL OF WOMEN	Did not appear
FORT ST. JOHN CHAMBER OF COMMERCE	Mr. A.R. Westgate
FORT ST. JOHN, CITY OF	Mr. G. Wilson
FORT ST. JOHN, HOSPITAL OF	Mr. G. Wilson
FORT ST. JOHN AND DISTRICT, PROFESSIONAL DEVELOPMENT ADVISORY COMMITTEE	Mr. P. Priebe Mr. B.C. Reid Ms. B. Sieben
FOX, Dr. I.K.	Self
FRIENDS OF THE PEACE	Mr. P. Maxcy
GERMAN, Mr. D.K.	Did not appear
GOULDIE, Mr. V.	Self
HADLAND, Ms. D.	Self

LIST OF PARTIES AND APPEARANCES
(cont'd)

PARTY	APPEARANCES
HADLAND, Mr. R.	Self
HADLAND, Mr. T.	Self
HANNAFORD, Mr. N.E.	Self
HANSEN, Mrs. D.	Did not appear
HAT CREEK ALLIANCE	Mr. D. Barz
HAT CREEK COALITION	Mr. P. Deverall
HELLIWELL, Dr. F.J.	Self
HERITAGE SOCIETY OF B.C.	Ms. M.E. Bayer Mr. R.R. Sutherland
HUDSON'S HOPE, DISTRICT OF	Mr. D. Lidstone
HUDSON'S HOPE, THIRTY-THREE RESIDENTS OF	Mr. A.P. Schuck
HUNTLEY, Mr. D.J.	Self
JOHANSSON, Ms. G.	Self
JOHNSON, Ms. C.	Did not appear
KIRKBY, Mr. R.	Did not appear
KOK, Mr. E.W.	Self
KYLLO, Mr. M.	Self
MARGOLICK, Dr. M.	Self
MARSH, Mr. M.	Did not appear
MATLAND, Mr. K.	Did not appear

LIST OF PARTIES AND APPEARANCES
(cont'd)

PARTY	APPEARANCES
McALLISTER, Mr. K.	Self
McDONALD, Ms. F.	Did not appear
McINTYRE, Mr. F.J.	Self
McWILLIAMS, Mr. P.	Did not appear
MINING ASSOCIATION OF B.C.	Mr. M.H. Mason
NATIONAL FARMERS UNTION	Ms. P. Staton
NATURAL RESOURCE ECONOMICS PROGRAM UBC	Did not Appear
NDP CAUCUS	Mr. C.A. D'Arcy Mr. R.E. Skelly Ms. B. Wallace
NORTH PEACE ROD AND GUN CLUB	Mr. L.R. Clapp
PEACE RIVER-LIARD REGIONAL DISTRICT	Mr. D. Lidstone
PEACE RIVER-LIARD RIVER UNION BOARD OF HEALTH	Did not appear
PEACE VALLEY ENVIRONMENTAL ASSOCIATION	Mr. K. Roberts Ms. M. Kansky Dr. A. Peacock
PETERSON, Mr. L.	Self
PETERSON, Mrs. L.	Self
POWELL, Mr. G.J.	Did not appear
PRATT, Mr. A.	Did not appear
RISING-MOORE, C.	Did not appear

LIST OF PARTIES AND APPEARANCES
(cont'd)

PARTY	APPEARANCES
ROBE, Ms. C.	Did not appear
ROSSANDER, Mr. M.	Did not appear
RUTLEDGE, Mr. L.	Self
SCHOBERT, Mr. L.	Did not appear
SCHOOL DISTRICT NO. 60, PEACE RIVER NORTH	Did not appear
SCHOAF, Mr. J.	Did not appear
SHUSWAP NUCLEAR STUDY ACTION GROUP	Mr. D. Charlton
SHUSWAP THOMPSON RIVER RESEARCH AND DEVELOPMENT ASSOCIATION	Mr. D. Charlton
SIERRA CLUB OF WESTERN CANADA	Mr. R. Gathercole
SOCIETY FOR THE PROMOTION OF ENVIRONMENTAL CONSERVATION	Ms. A. Rounthwaite Mr. C. Stainsby
SOUTH TAYLOR-TOWER LAKE COMMITTEE FOR REGIONAL INDEPENDENCE	Did not appear
SYKES, Mr. E.	Self
TAYLOR, VILLAGE OF	Mr. D. Lidstone
TELFORD, Ms. M.E.	Did not appear
TIMBERLINE TRAIL AND NATURE CLUB	Did not appear
TREATY 8 TRIBAL ASSOCIATION	Mr. R. Salter
UNITED NATIVE NATIONS	Ms. D. Tyndall Mr. W. Lightbrown Mr. F. Storey
UBC LAND USE STUDY GROUP	Mr. R.J. Rowed Ms. S. Nitins Mr. R. Emerson

LIST OF PARTIES AND APPEARANCES
(cont'd)

PARTY	APPEARANCES
VENTRESS, Mr. & Mrs. R.A.	Did not appear
WEBER, Mr. M.	Self
WESTCOAST TRANSMISSION CO. LTD.	Mr. P. Griffin
WICHLINSKI, Mr. P.	Self
WILCOCKS, Mrs. K.M.	Did not appear

B. Less Formal Hearings

1. Fort St. John - February 11, 1982 and June 22, 1982

UPPER HALFWAY CATTLEMEN'S ASSOCIATION
(Mr. G. Gieni)

NORTH PEACE HISTORICAL SOCIETY -
FORT ST. JOHN MUSEUM BOARD
(Ms. S. Burley)

ATKINS, Mr. T.

BLONKE, Mr. P.

DARNELL, Ms. R.A.

FUHR, Mr. E.

GENTLES, Mr. W.

GRAHAM, Ms. N.

HALL, Mr. K.

HALLS, Mr. M.

HEMINGWAY, Ms. A.

JONES, Mr. A.

KEER, Mr. S.

LABOUCANE, Ms. A.

LABOUCANE, Mr. P.

MACKLIN, Ms. D.

MARSH, Mr. M.

MASCIANGELO, Ms. H.

PETERSON, Mr. R.

PHILLIPS, Ms. K.

ROBE, Ms. C.

SHOAF, Ms. J.

TODRICK, Ms. B.

TOEWS, Mr. D.

TOEWS, Mr. E.

TUCKER, Mr. G.

WHITING, Mr. D.

LIST OF PARTIES AND APPEARANCES
(cont'd)

2. Taylor - February 18, 1982

GERMAN, Mr. D.
HADLAND, Ms. L.
HADLAND, Mr. R.
HEALEY, Ms. C.
McDONALD, Ms. F.
O'CONNEL, Mr. B.
ROBINSON, Ms. A.
SHORT, Ms. C.

3. Hudson's Hope - February 25, 1982

ARDILL, Mr. J.
BRADIGAN, Ms. L.
ENDERLIN, Ms. P.
GILBEY, Mr. D.
JOSLIN, Ms. D.
JOSLIN, Mr. D.
KYLLO, Mr. K.
KYLLO, Mr. M.
KYLLO, Mrs. E.
MacKIEGAN, Mr. T.
MATTHEWS, Mr. C.
McWILLIAMS, Ms. A.
NILSON, Ms. B.
PERSSINI, Mr. T.
SCOREY, Ms. H.
SYKES, Mr. E.
SYKES, Ms. J.

4. Chetwynd - March 3, 1982

BURKINSHAW, Mr. R.

CHETWYND CHAMBER OF COMMERCE
(Mr. D. Brulotte)

LASSER, Mr. C., Mayor
(representing the
Municipality of Chetwynd)

SCHMOK, Mr. M.

LIST OF PARTIES AND APPEARANCES
(cont'd)

5. Dawson Creek - April 1, 1982

TIMBERLAND TRAIL AND NATURE CLUB
(Mr. E. Baker)

EXNER, Mr. J.

HADLAND, Mr. D.

MATHESON, Ms. A.

McINTYRE, Mr. J.

MICHIEL, Mr. P.

SHOEN, Mr. W.

C. Special Hearings*

1. Moberly, B.C. - March 4, 1982

DAVIS, Mr. A.

DAVIS, CHIEF JACK

DAVIS, Mr. M.

DAVIS, Mrs. P.

DAVIS, Mrs. V.

DESJARLAIS, Mr. M.

DOKIE, CHIEF JOHN

GAUTHIER, Ms. A.

GAUTHIER, Mr. D.

GAUTHIER, Mr. O.

GAUTHIER, Ms. S.

NAPOLEON, Mr. B.

NAPOLEON, Mrs. E.

NAPOLEON, Mr. S.

2. Blueberry Reserve - March 18, 1982

ACKO, Mr. L.

APSASSIN, Mr. C.

APSASSIN, Mr. E.

ATTACHIE, Mr. G.

ATTACHIE, Mr. T.

CALAHASEN, Mr. J.

LIST OF PARTIES AND APPEARANCES
(cont'd)

2. Blueberry Reserve - March 18, 1982 (cont'd)

APSASSIN, Mr. M.
APSASSIN, Mrs. N.
APSASSIN, Mr. R.
APSASSIN, Mr. V.
APSASSIN, Mr. W.
CHEEKYASS, Mr. A.
CHIPESIA, Mr. H.
DAVIS, CHIEF GERRY
DAVIS CHIEF KELVIN
DOMINIC, Mr. D.

3. Halfway Reserve

ACHLA, Mr. D.
ACHLA, Ms. J.
ANDREW, Mr. J.
FIELD, Mr. A.
FIELD, Mrs. Z.
FOX, Mr. S.
HUNTER, Mr. F.
JACKSON, Mr. B.
METECHIE, Mr. D.
METECHIE, Mrs. E.
METECHIE, Mrs. M.
METECHIE, CHIEF GRACE
WOLFE, Mr. F.
WOLKLY, Mr. J.
WOLKLY, Mr. M.

* These hearings were organized with the assistance of the Treaty 8 Tribal Association. Each witness appeared on his or her own behalf.

APPENDIX 6

WITNESSES BY PHASE AND ORDER OF APPEARANCE

CALLED BY	PANEL MEMBERS	COUNSEL	EXHIBITS	TRANSCRIPT REFERENCES
Phase I				
B.C. Hydro	Mr. W.A. Best Mr. C.C. Purves Mr. T.J. Newton Mr. J.R. Brassington	Ms. D. Barnett	28-36 39-41	Vol. 1, Pg. 44 to Vol. 4, Pg. 695
Electrical and Electronic Manufacturers' Assoc. of Canada	Mr. G.A. Vaughan Mr. D.E. Armour Mr. D.J. Turland Mr. W.N. Isberg		42,43	Vol. 5, Pg. 698 to Pg. 917
B.C. Hydro	Mr. W.A. Best Mr. C.C. Purves Mr. T.J. Newton Mr. J.R. Brassington	Ms. D. Barnett	44-51	Vol. 6, Pg. 918 to Vol. 7, Pg. 1,169
B.C. Hydro	Mr. W.A. Best Mr. D. Priestman	Ms. D. Barnett	52-54	Vol. 7, Pg. 1,172 to Vol. 8, Pg. 1,333
Ministry of Energy, Mines and Petroleum Resources	Mr. G.P. Taunton Mr. R.A. Preece	Mr. E.N. Hughes	55-60	Vol. 9, Pg. 1,334 Vol. 10, Pg. 1,707
Mr. L. Rutledge	Self		61	Vol. 11, Pg. 1,728 - 1,770
Mr. R. Hadland	Self		62	Vol. 11, Pg. 1,771 - 1,794
B.C. Utilities Commission	Dr. A.R. Tussing Mr. R. Lewis	Commission Counsel	63	Vol. 11, Pg. 1,795 to Vol. 12, Pg. 1,954
Mining Association of B.C.	Mr. P.R. Matthew	Mr. M.H. Mason	78	Vol. 19, Pg. 3,186 - 3,246
Ministry of Industry and Small Business Development	Mr. L.R. Sivertson Mr. B. McRae Mr. R. Singh	Mr. E.N. Hughes	79-82	Vol. 20, Pg. 3,256 to Vol. 21, Pg. 3,577
B.C. Utilities Commission	Columbia-Pacific Resources Group Mr. D.G. Hildebrand Mr. D.W. Ross	Commission Counsel	83-85	Vol. 21, Pg. 3,584 Vol. 22, Pg. 3,732

WITNESSES BY PHASE AND ORDER OF APPEARANCE

PHASE I (cont'd)

CALLED BY	PANEL MEMBERS	COUNSEL	EXHIBITS	TRANSCRIPT REFERENCES
Dr. J. Helliwell	Self	Commission Counsel	85A-E	Vol. 23, Pg. 3,735 - Pg. 3,913
Dr. M. Margolick	Self		89-95	Vol. 25, Pg. 4,142 - 4,325
Ministry of Energy, Mines & Petroleum Res.	The Honourable R.H. McClelland	Mr. E.N. Hughes	86-88	Vol. 24, Pg. 3,915 - 4,112
Society Promoting Environmental Conservation	Mr. R.J. Overstall	Ms. A. Rounthwaite	96-98	Vol. 26, Pg. 4,329 - 4,397
Mr. P.J. McIntyre			99	Vol. 26, Pg. 4,399 - 4,413
B.C. Hydro	Mr. J.R. Brassington	Ms. D. Barnett	100-102	Vol. 26, Pg. 4,414 - 4,486

*The following Phase I Evidence was heard in Vancouver between October 5 and October 8, 1982.

CALLED BY	PANEL MEMBERS	COUNSEL	EXHIBITS	TRANSCRIPT REFERENCES
1.	Mr. W.A. Best Mr. R. Buckland Mr. G. Engbloom Mr. J.J. Gibbon Mr. E.N. Halvorson Mr. W.H. Palmer Mr. C.C. Purves	Ms. D. Barnett	424-432, 23A,433- 436-429A 441-442	Vol. 108, Pg. 17,537 to Vol. 109, Pg. 17,906 Vol. 110, Pg. 17,963 to Vol. 111, Pg. 18,196

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CALLED BY	PANEL MEMBERS	COUNSEL	EXHIBITS	TRANSCRIPT REFERENCES
B.C. Hydro	Mr. D. Forrest Mr. K. Peterson Mr. D. Craig Mr. E. Martin	Ms. D. Barnett	103-123	Vol. 27, Pg. 4,497 to Vol. 32, Pg. 5,488
Society Promoting Environmental Conservation	Mr. K.A. Cooper	Ms. A. Rounthwaite	124	Vol. 32, Pg. 5,489 - 5,563
Mr. L. Rutledge	Self		125,126	Vol. 33, Pg. 5,566 - 5,622
Mr. R. Hadland	Self		127,128	Vol. 33, Pg. 5,623 - 5,709

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PHASE II (cont'd)				
Mr. N.E. Hannaford	Self		129	Vol. 34, Pg. 5,710 - 5,778
PHASE III				
B.C. Hydro	Mr. D.S. Cathcart Mr. K.H. Lashley Mr. E.H. Martin Mr. J.E. Hardy Mr. A.S. Imrie Mr. G.C. Morgan Mr. W.A. Power	Ms. D. Barnett	136-163 169-179	Vol. 34, Pg. 5,782 to Vol. 38, Pg. 6,378 Vol. 40, Pg. 6,445 to Vol. 42, Pg. 6,855
Mr. A.J. Brummet	Self		164-168	Vol. 39, Pg. 6,379 - 6,429
Mr. L. Rutledge	Self			Vol. 42, Pg. 6,856 - 6,886
Ministry of Environment	Mr. H.M. Hunt Mr. C.P. Ripley	Mr. W. Pierce	181-187	Vol. 43, Pg. 6,890 to Vol. 44, Pg. 7,061
Surveyor Henniger Chenevert	Mr. R.I. Gilchrist	Commission Counsel	190	Vol. 44, Pg. 7,066 - 7,073
B.C. Hydro	Mr. D.S. Cathcart Mr. W.M. Walker	Ms. D. Barnett	213	Vol. 46, Pg. 7,329 - 7,344
			188-189	Entered in Va 44
PHASE IV				
B.C. Hydro 1.	Mr. G.A. Constable Mr. H.M. Etter Mr. J.T.R. Husdon Mr. R.L. MacDonald Mr. K.G. Peterson Mr. J.A. Waite Dr. S.E. Tuller Mr. E.H. Martin	Ms. D. Barnett	191-212 214A-D 215-221,221A 222-229	Vol. 44, Pg. 7,095 to Vol. 51, Pg. 8,324

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	2.	Mr. G.R. Ash Mr. D.A. Blood Mr. M.C. Quick Mr. G.F. Kennedy Mr. J.A. Waite Mr. G.A. Constable Dr. D.S. Cathcart Mr. E.H. Etter Mr. D. Williams	Ms. D. Barnett	230-233 234A,B 235-239 240A,B 241-258	Vol. 52, Pg. 8,329 to Vol. 59, Pg. 9,672
B.C. Hydro (cont'd)	3.	Mr. B.I. Spurling Mr. D. Williams Mr. D. Macdonald Mr. J.P. Thompson Mr. K.G. Peterson Mr. J.A. Waite	Ms. D. Barnett	259-261 262-264,253A	Vol. 60, Pg. 9,673 to Vol. 62, Pg. 10,101
	4.	Mr. J.A. Waite Mr. G.R. Staple Ms. C. Lattey Mr. W.A. Power Mr. K.G. Peterson Mr. E.H. Martin Mr. J.N. Holmes Mr. C. Boatman	Ms. D. Barnett	265,266,266A 261A,267-271 253B,272-276	Vol. 63, Pg. 10,103 to Vol. 69, Pg. 11,202
Ministry of Industry and Small Business Development		Mr. P. Basetti Mr. L.R. Sivertson	Mr. E.N. Hughes	265A,277, 277A-D, 278	Vol. 69, Pg. 11,214 - 11,324
Ministry of Forests		Mr. J.R. Cuthbert Mr. H.V. Lewis Mr. D.A. MacLennon Mr. W.G. Swanson	Mr. E.N. Hughes	279,280	Vol. 70, Pg. 11,329 - 11,393
Ministry of Transportation and Highways		Mr. M.G. Elston Mr. L.D. Perkins	Mr. E.N. Hughes	281-283,152A	Vol. 71, Pg. 11,397 - 11,540
Ministry of Provincial Secretary and Government Services		Mr. A.S. Charleton Mr. B.C. Apland	Mr. E.N. Hughes	283,284	Vol. 72, Pg. 11,551 - 11,691
Ministry of Labour		Mr. C.G. Heywood Mr. J. Schuyff	Mr. E.N. Hughes	285	Vol. 72, Pg. 11,693 to Vol. 73, Pg. 11,816

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Mr. M. Kyllo			286	Vol. 73, Pg. 11,819 - 11,828
Mr. L. Rutledge			289A-M,290 319A,B	Vol. 74, Pg. 11,840 - Vol. 81, Pg. 11,939
Ms. G. Johansson			292-294,295A 295B,296A-J 297	Vol. 75, Pg. 11,948 - 11,994
City of Fort St. John	Mr. S. Kary Mr. B.E. Palmer	Mr. G. Wilson	298,298A, 299,300	Vol. 75, Pg. 11,995 to Vol. 76, Pg. 12,154
Hospital of Fort St. John	Mr. C. Wilson	Mr. G. Wilson	301	Vol. 76, Pg. 12,154 - 12,165
North Peace Rod and Gun Club	Mr. L.R. Clapp			Vol. 76, Pg. 12,166 - 12,207
Mr. L. Peterson Mrs. L. Peterson			302-306	Vol. 76, Pg. 12,212 to Vol. 77, Pg. 12,320
Mr. R. Hadland	Self		307	Vol. 77, Pg. 12,322 - 12,334
Professional Development Advisory Committee	Mr. P. Priebe Mr. B.J. Reid Ms. B. Seiben		308	Vol. 77, Pg. 12,336 - 12,441
Mr. A.J. Brummet				Vol. 78, Pg. 12,445 - 12,539
Fort St. John Chamber of Commerce	Mr. A.R. Westgate		310	Vol. 79, Pg. 12,542 - 12,549
National Farmers Union	Ms. J. Leahy Ms. E. Landry Mr. L. Leahy Mr. L. Schubert Mr. J. Curtis Mr. M. Lucas	Ms. P. Staton	311-317	Vol. 79, Pg. 12,550 - 12,740
B.C. Hydro	Mr. J.N. Holmes Mr. E.H. Martin Mr. W.A. Power	Ms. D. Barnett	318,319A,B 230,321	Vol. 80, Pg. 12,744 to Vol. 81, Pg. 12,997

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Mr. V. Gouldie				Vol. 81, Pg. 12,998 - 13,005
Mr. R. Enderlin Mr. E. Sykes			322-324	Vol. 81, Pg. 13,007 - 13,025
Peace Valley Environmental Association	1. Mr. L. Schobert Mr. P. Michiel Ms. R. Darnall	Mr. K. Roberts		Vol. 81, Pg. 13,026 - 13,041
	2. Mr. C. Siddle	Mr. K. Roberts	325	Vol. 81, Pg. 13,042 - 13,093
	3. Mr. R. Harper	Mr. K. Roberts	326	Vol. 81, Pg. 13,094 - 13,115
Golder Associates	Mr. A. Kent Mr. J. Van Ryswyck	Mr. D. Lidstone	327-330	Vol. 82, Pg. 13,124 - 13,147
Dr. A.R. Thompson Mr. A. Skaburskis Dr. G. Battersby Mr. J.T. MacKeigan		Mr. D. Lidstone	331-341 342A-C 343-346	Vol. 82, Pg. 13,147 to Vol. 83, Pg. 13,515
District of Hudson's Hope	Mr. H. Hodgkinson Mr. P.E. Lavallee Mr. P. Yeoman	Mr. D. Lidstone	347-349A-C	Vol. 84, Pg. 13,516 - 13,623
Peace River-Liard Regional District	Mr. J. Hahnan Mr. M. Stewart Mr. D. Ammond	Mr. D. Lidstone	350	Vol. 84, Pg. 13,626 13,700
33 Property Owners of The Hudson Hope River Bank Association	Mr. A. Kent Mr. R. Van Ryswyk	Mr. A.P. Schuck		Vol. 85, Pg. 13,704 - 13,773
Corporation of the Village of Taylor	Mr. D.J. McWalter Mr. A. Von Hollen	Mr. D. Lidstone	351-356	Vol. 85, Pg. 13,774 - 13,848
Don Peck Holdings Ltd.	Mrs. A. Peck	Mr. G. Cranston	358	Vol. 85, Pg. 13,859 - 13,882
Ministry of Agriculture	Mr. M. Aiyadurai Mr. D.J. Anderson Mr. B. Baehr Mr. L.E. Bomford Mr. R. Kline Mr. D.M. Matviw	Mr. E.N. Hughes	359A,B 215A,B-360 361A-D,362-368, 369	Vol. 86, Pg. 13,888 to Vol. 88, Pg. 14,444

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Ministry of Environment	Mr. R.E. Davis Mr. G.E. Cheeseman	Mr. E.N. Hughes		Vol. 88, Pg. 14,446 to Vol. 89, Pg. 14,480
Ministry of Lands, Parks and Housing	Mr. B.W. Dyck Mr. T. Lee Mr. D. P. Macaulay Mr. R.W. Norrish	Mr. E.N. Hughes	258A,B-370	Vol. 89, Pg. 14,480 to Vol. 90, Pg. 14,680
Treaty 8 Tribal Association	1. Mr. H. Brody Dr. M. Weinstein Mr. G. Hunter Mr. B. Napoleon	Mr. R. Salter	371-374,374A 375-380 381,382,383A,B 384	Vol. 90, Pg. 14,683 to Vol. 91, Pg. 14,853
	2. Mr. M. Jackson Mr. B. Napoleon Mr. S. Napoleon	Mr. R. Salter		Vol. 91, Pg. 14,853 - 14,905
	3. Mr. H. Brody Mr. G. Hunter Mr. B. Napoleon Mr. S. Napoleon Mr. M. Weinstein	Mr. R. Salter	385	Vol. 91, Pg. 14,905 to Vol. 92, Pg. 15,150
	4. Mr. H. Brody Mr. B. Napoleon Mr. M. Weinstein Mr. R. Justus	Mr. R. Salter	386 408A,B	Vol. 93, Pg. 15,151 - 15,305
Peace Valley Environmental Association	Dr. C. Krebs	Mr. K. Roberts	387	Vol. 94, Pg. 15,307 - 15,383
Peace Valley Environmental Association	Dr. R.A. Bodaly	Mr. K. Roberts	388A-C,389	Vol. 94, Pg. 15,383 to Vol. 95, Pg. 15,521
Peace Valley Environmental Association	Dr. P. Bentley Dr. V. Brink Dr. R. Harris Dr. E. Manning Mr. G. Runka Dr. J. Warnock	Mr. K. Roberts	390A-C, 391A-D,392, 393A,B394A-E 395-397	Vol. 94, Pg. 15,522 to Vol. 97, Pg. 16,034
B.C. Federation of Agriculture	Mr. D.A. Knoerr Mr. J. Hoogendoorn		398,398A-C	Vol. 98, Pg. 16,038 - 16,110

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B.C. Institute of Agrologists	Dr. A.A. Bomke	Mr. K. Roberts	399	Vol. 98, Pg. 16,111 - 16,175
Society Promoting Environmental Conservation	Dr. W.B. Lord	Ms. A. Rounthwaite	400,400A-C	Vol. 98, Pg. 16,176 to Vol. 99, Pg. 16,350
Westcoast Transmission	Mr. P.W. Soper Mr. D.G. Waller	Mr. Griffin	401-404	Vol. 99, Pg. 16,352 - 16,401
Association of B.C. Professional Foresters	Mr. W.A. Hopwood		405	Vol. 99, Pg. 16,401 - 16,426
United Native Nations	Ms. D. Tyndall Mr. W. Lightbrown Mr. F. Storey		406, 406A	Vol. 100, Pg. 16,428 - 16,468
Sierra Club	Mr. R. Miles	Mr. G. Gathercole	407	Vol. 100, Pg. 16,469 - 16,499
Ministry of Environment	Mr. J. O'Riordan Mr. D.H.J. Ableson Mr. A.B. Mitchell Mr. F. Harper	Mr. E.N. Hughes	152B, 409, 410	Vol. 101, Pg. 16,502 to Vol. 103, Pg. 17,073
B.C. Wildlife Federation	Mr. G.F. Kenyon		411, 411A, 382A	Vol. 104, Pg. 17,081 - 17,125

* The following Phase IV evidence was heard in Vancouver between October 5 and October 8, 1982.

B.C. Hydro	Mr. E.L. Pottinger Mr. J.T.R. Hudson	Ms. D. Barnett	437-440	Vol. 110, Pg. 17,908 - 17,963
PHASE V				
B.C. Hydro 1.	Mr. R.E. Avery Mr. J.S. Black Mr. D.W. Craig Mr. R.A.C. MacGillivray	Ms. D. Barnett	412-417 417A 418-423	Vol. 105, Pg. 17,133 to Vol. 107, Pg. 17,529

WITNESSES BY PHASE AND ORDER OF APPEARANCE

Vancouver Session Covering All Phases
Witnesses in order of appearance

CALLED BY	PANEL MEMBERS	COUNSEL	EXHIBITS	TRANSCRIPT REFERENCES
Communists Party of British Columbia	Mr. M. Rush			Vol. 13, Pg. 1,972 - 2,042
Mr. D.J. Huntley			64	Vol. 13, Pg. 2,043 - 2,094
Mr. E.S. Chessor				Vol. 13, Pg. 2,095 - 2,157
NDP Caucus	Mr. R.E. Skelly Mr. C.A. D'Arcy Ms. B. Wallace		65	Vol. 14, Pg. 2,158 - 2,366
Hat Creek - Alliance	Mr. D. Barz		66	Vol. 15, Pg. 2,367 - 2,399
Hat Creek Coalition	Mr. P. Deverell		67	Vol. 15, Pg. 2,399 - 2,415
Heritage Society of British Columbia	Ms. M.E. Bayer Mr. R.R. Sutherland			Vol. 15, Pg. 2,416 - 2,450
UBC Land Use Study Group	Mr. R.J. Rowed Ms. S. Nitins Mr. R. Emerson		68	Vol. 15, Pg. 2,451 - 2,536
Mr. P. Wichlinski				Vol. 15, Pg. 2,356 - 2,550
Mr. K. McAllister				Vol. 16, Pg. 2,556 - 2,575
Friends of the Peace	Mr. P. Maxcy		69, 70	Vol. 16, Pg. 2,576 - 2,715
B.C. Chamber of Commerce	Mr. N.D. McLaren Mr. M.A. Thomas	Mr. Wright	72	Vol. 16, Pg. 2,722 - 2,784
Mr. M.E. Weber				Vol. 17, Pg. 2,789 - 2,832
Mr. J.M. Black			73, 74	Vol. 17, Pg. 2,832 - 2,919

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CALLED BY	PANEL MEMBERS	COUNSEL	EXHIBITS	TRANSCRIPT REFERENCES
Vancouver Session (cont'd)				
Archaeological Society of B.C.	Ms. S.M. Veale Mr. N. Russell			Vol. 17, Pg. 2,920 - 2,957
Shuswap Nuclear Study Action Group and the Shuswap-Thompson River Research and Development Association	Mr. D. Charlton		75	Vol. 17, Pg. 2,958 - 2,975
Dr. I.K. Fox			76, 77	Vol. 18, Pg. 2,976 - 2,3166
Mr. E. Butterworth				Vol. 18, Pg. 3,155 - 3,182

APPENDIX 7

LIST OF EXHIBITS

	Exhibit No.
B.C. Order in Council dated April 23, 1981 BCUC	1
Disposition of Application and Terms of Reference for Review by B.C. Utilities Commission	2
B.C. Utilities Commission Order No. G-41-81 dated June 18, 1981	3
B.C. Utilities Commission Order No. G-55-81 dated July 10, 1981	4
B.C. Utilities Commission Order No. G-59-81 dated July 29, 1981	5
B.C. Utilities Commission Order No. G-74-81 dated October 7, 1981	6
B.C. Utilities Commission Order No. G-75-81 dated October 7, 1981	7
B.C. Utilities Commission Order No. G-76-81 dated October 7, 1981	8
B.C. Utilities Commission Order No. G-80-81 dated October 27, 1981	9
B.C. Utilities Commission Order No. G-81-81 dated October 27, 1981	10
List of Registered Intervenors in Order of Appearance - BCUC	11
Assessment of B.C. Hydro Electric Load Forecasts including comparisons with B.C. Government's Forecasts prepared by Columbia-Pacific Resources Group Ltd. - BCUC	12

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B.C. Hydro and Power Authority - Peace Site C Project Application for an Energy Project Certificate dated September 9, 1980	15
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B.C. Hydro Projections of Gross Load Requirements - All services 1980/1981: 1980/1991 dated September 1980 - BCUC	18
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Affidavit of C.W.J. Boatman dated November 25, 1981 - B.C. Hydro	19A
B.C. Hydro - Additional Information submitted in answer to BCUC - Questions of September 11, 1981 - Volume 1 dated October 10, 1981	20
B.C. Hydro - Additonal Information submitted in answer to BCUC - Questions of September 11, 1981 - Volume 2 dated October 10, 1981	21

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B.C. Hydro - Power District and Divisional involvement in Electric Load Forecast dated September, 1981	22
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B.C. Hydro - Opening Statement of J.R. Brassington Manager of Special Contracts Department of B.C. Hydro	28
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Prepared Statement of T.J. Newton, Manager of The Conservation Division of B.C. Hydro - B.C. Hydro	30
B.C. Hydro Organization Chart No. 1 and Chart No. 2	31
B.C. Hydro -A Review of Studies of the Demand for Electricity prepared by NERA dated November 20, 1981	32

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B.C. Hydro Study - Project 7854 Electric Motors Potential Impact on Energy Conservation and Energy Needs in B.C. 1980-2005	35
B.C. Hydro Study - Project 7856 The Impact of Weatherization of Electrically Heated Homes on Energy Conservation and Energy Needs in the B.C. Hydro System	36
B.C. Hydro Study - Project 7853 Residential Water Heatings and Appliances Potential Impact on Energy Conservation and Energy Needs in B.C. 1980-2005	37
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Letter from BCUC to B.C. Hydro dated July 29, 1981 - Request for Information Related to the Request for Interim Rate Relief and B.C. Hydro's Reply dated July 31, 1981 -BCUC	39
B.C. Hydro -The Potential Market for B.C. Exports to the U.S.A. prepared by E.C. Sievwright Associates Limited dated November 1981	40
B.C. Hydro -Electric Power Supply and Demand in the Pacific Northwest dated July 1979	41
Submission of the Electrical and Electronic Manufacturers Association of Canada dated November 3, 1981 - EEMAC	42

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B.C. Hydro Tables of Comparative Energy Prices, Residential Heating Cost Comparisons and Comparison of Estimated Energy Prices	44
B.C. Hydro Marginal Cost Study	45
SPEC -An Energy Secure British Columbia. The Challenge and The Opportunity dated February 1980	46
B.C. Hydro -Analysis of B.C. Hydro Forecasting Planning Performance in the 1970's	47
B.C. Hydro - Peace Site C Project Environmental Impact Statement	48
B.C. Hydro - Schedule, Energy Conservation Components in 1981 Load Forecast	49
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B.C. Hydro - Donald Priestman - Professional Resume	54
Technical Report April 1981 - British Columbia Energy Supply and Requirements Forecast 1980-1995 MEM & PR	55

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Comparison of Residential Natural Gas/Electricity Prices dated December 8, 1981 - MEM & PR	57
Ministry of Energy, Mines and Petroleum Resources - 1980 Forecast Table 4.38 - Forecast Primary Energy Consumption in Copper and Molybdenum Mines. 1981 Forecast Table 4.50A - Base Case Energy Requirements Forecast for Copper and Molybdenum Mines. 1980 Forecast Table 4.57 - Primary Metals Sector Best Estimate Energy Requirements Forecast. 1981 Forecast Table 4.65A - Base Gas Energy Requirements Forecast: Primary Metals - BCUC	58
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Seattle City Light 1980 Annual Report - B.C. Hydro	74
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Submission of Irving K. Fox dated December 30, 1981	76
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Submission of the Mining Association of British Columbia dated January 15, 1982	78
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The Link Between Electricity Prices and The Need for New Dams in British Columbia - January 1982 - J.F. Helliwell and M. Margolick	85A
Competing Energy Uses for Wood Wastes in British Columbia, Michael Margolick, Ardo H. Hansson, John F. Helliwell - Resources - Paper No. 65 July 1981 - J.F. Helliwell and M. Margolick	85B
Electricity Generation from Wood Wastes in British Columbia, Michael Margolick, John F. Helliwell Resources - Paper No. 69 September 1981	85C
Energy Economics October 1979. - Article, Primary Energy Demand in Canada by Robert N. McRae - J.F. Helliwell and M. Margolick	85D
Canadian Journal of Economics, November 1981. Canadian Energy Pricing by John F. Helliwell - J.F. Helliwell and M. Margolick	85E
Letter SPEC January 7, 1982 - J.M. Hill, M.E.M. & P.R. and the Reply January 18, 1982. Referring to The Role of The Conservation Branch in The Formation of Provincial Energy Policy - SPEC	86

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Western Trade Objectives. Position Paper Western Premiers' Conference Yorkton, Saskatchewan April 13-14, 1978 - MEM & PR	90
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APPENDIX 8

SITE C STAFF

Mr. Derek Leach - Director, Hearing Coordinator

Mr. John Grunau - Director, Economics and Environment

Dr. Yuwa Wong - Economist, Economics and Environment

Mr. R.J. Fletcher - Director, Accounting and Financial Analysis

Mr. John Hague - Analyst, Accounting and Financial Analysis

Dr. F.L. Stremotich - Director, Electrical Engineering

Mr. Jim Bogyo - Director, Major Energy Project Review

Mr. Ray Godfrey - Communications Coordinator, Major Energy Project Review

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APPENDIX 9

DRAFT CONDITIONAL WATER LICENCE

The British Columbia Hydro and Power Authority of 970 Burrard Street, Vancouver, British Columbia is hereby authorized to divert and use water as follows:

(a) the source of the water supply is the Peace River.

(b) the point of diversion is located as shown on the attached plan, Exhibit "A".

(c) the date from which this Licence shall have precedence is 30th December 1980 subject to clause (j) hereof.

(d) the purpose for which water may be used is power.

(e) the maximum quantity of water which may be diverted and used is 2209 cubic meters per second (78,000 cubic feet per second).

(f) the period of the year during which water may be used is the whole year.

(g) this Licence is appurtenant to the undertaking of the Licencee.

(h) the works authorized to be constructed are an earth fill dam, power house, spillway, low level outlets and associated works.

(i) the Licencee shall not commence construction of the authorized works, or portions thereof until the Comptroller of Water Rights has determined that the final plans for the project are consistent with the preliminary plans reviewed by the British Columbia Utilities Commission or has approved in writing any deviation from those preliminary plans.

(j) the Licencee's rights granted herein shall be deemed subsequent to those granted under any Licence or Licences that may be issued at any time for the consumptive use of water.

(k) the normal full pool elevation at the dam is 461.8 meters (1,515 feet) and may not fluctuate above this level by more than 0.6 meters or below this level by more than 0.8 meters without prior consent of the Comptroller of Water Rights.

(l) the Licencee shall, as directed by the Comptroller of Water Rights, establish and maintain a warning system designed to alert the public to all significant changes in water level, however caused.

(m) the Licencee shall not cause the instantaneous flow in the Peace River at Taylor to be less than the flow authorized by the Conditional Water Licence held by the Licencee for the Bennett Dam on the Peace River.

(n) the Licencee shall inspect known potential slide areas as frequently as appropriate but at least annually and report on the results of the inspection to the Comptroller of Water Rights.

(o) The Licencee shall annually inspect the reservoir perimeter to identify new slide areas and report the results of these inspections to the Comptroller of Water Rights.

(p) The Licencee shall constantly monitor bank stability around the perimeter of the reservoir during flooding and monitor the stabilization of the banks after flooding.

(q) The Licencee shall post specific warning signs differentiating between those areas of the reservoir which are safe for public use and those which are not.

Rationale and Criteria for Cost Awards in the Site C Review

The SiteC Panel found that the Ministries were considering the matter of funding of costs when it began the review of Hydro's applications. Various intervenors indicated their need for funding early in the process and as a result the Panel considered the matter. The Utilities Commission Act, R.S.B.C. Section 133(1) states:

> "The costs incidental to a proceeding before the Commission are in the discretion of the Commission and it may order by whom and to whom and in what amount the costs are to be paid."

The Site C Commission concluded that this section of the Act allowed the Commission to award the payment of costs but it was also evident that there was no explicit provision in the Act for the advance funding of intervenors.

During the informal public meeting held in Fort St. John on July 28, 1981 several of the intervenors brought up the matter of costs and, because of its importance, hoped that an early decision in favour of this matter would be made. A decision was made during a panel meeting on July 29, 1981 that an Order be prepared which the Panel Chairman could discuss with the Commission Chairman and the appropriate Ministry. In a subsequent Panel meeting on August 29, 1981 a majority of the Panel decided that if funding was not forthcoming from the Ministry the Site C Panel would follow the legislation and award costs to intervenors.

The decision by the Ministries concerned was that no advance funding would be allowed. A majority of the Panel concluded that concise instructions relative to costs be given as part of the Chairman's prepared statement at the Pre-Hearing Conference to be held in Fort St. John on October 7th, 1981. (P. 139)

When the agenda item on the award of costs came up at the Pre-Hearing Conference, the Chairman read into the record the prepared statement on this subject. The statement set out the general criteria for awarding of costs with the provision that there would not be any advance awards of costs and that these will only be made after the hearings. Several intervenors gave convincing reasons that to award costs only after the hearings would severely restrict public participation in the review process. Because of this argument the Panel decided to modify this provision and allow interim awarding of costs. As a result, Order G-74-81 together with an annexure of the general criteria was issued on October 7, 1981 and sent to the Applicant and Intervenors. This Order and annexure is attached as Annex A.

When the cost claims started to come in and the processing and payment of claims proceeded, it became apparent that rules regarding fees paid to outside consultants were required and that rules to facilitate the processing of cost claims needed to be streamlined. These new procedures were read into the record on the 20 April, 1982 and are shown in Annex B.

The recommendations with respect to fees were set out in a short brief entitled "Guidelines For Cost Applications" and are shown in Annex C.

Order G-74-81 and its annexure together with the "Guidelines For Cost Applications" and the new procedures form the basis for awarding of costs to intervenors.

ANNEXES

A	Board Order G-74-81 dated October 7, 1981 and Annexure A
B	Pages 8362 and 8363 Vol. 52 of Transcripts Site C Generation/Transmission Project
C	Guidelines For Cost Applications

BRITISH COLUMBIA
UTILITIES COMMISSION

ORDER
NUMBER G-74-81

PROVINCE OF BRITISH COLUMBIA

BRITISH COLUMBIA UTILITIES COMMISSION

IN THE MATTER OF the Utilities Commission Act, SBC 1980, c. 60

and

IN THE MATTER OF an application (the "Application") by British Columbia Hydro and Power Authority ("B.C. Hydro") for an Energy Project Certificate for the Peace River Site C Generation/Transmission Project

BEFORE: K.A. Henry, Chairman, Site C Division;)
E.E. Little, Commissioner;) October 7, 1981
R.A. Petrick, Commissioner; and)
L. Ryan, Commissioner)

ORDER

WHEREAS the Commission wishes to make provision for the timing and nature of awards of costs, if any, to be made to the parties to the Hearing in respect of the Application.

NOW THEREFORE the Commission Orders that:

1. Applications for costs incurred on or before the date of this Order by parties to the Hearing incidental to preparation of any document filed or required to be filed with the Commission prior to the date of this Order or preparation for and attendance at the Informal Pre-Hearing meeting held in Fort St. John, British Columbia, on July 28, 1981, or the Pre-Hearing Conference held on October 7th, 1981 will be received by the Commission at any time after the date of this Order.

2. Applications for costs incurred by parties to the Hearing in connection with particular Phases of the Hearing will be considered at the conclusion of the Phase in respect of which the application for costs is made or at such other intervals as the Commission may direct.

3. All applications for costs are to be accompanied by a Bill of Costs and should briefly indicate the reason costs are required and the identity of the party against whom the award should be made. The Bill of Costs should be verified by receipts or vouchers for all items claimed or, where appropriate, by affidavit.

4. Upon receipt of an application for costs, the Commission will forward the costs application to the party against whom the award is sought and the party will have ten (10) days in which to file a written response to the application for costs.

5. Upon the expiry of the time period specified in paragraph 4 hereof, the Commission will dispose of all costs applications on a case by case basis employing the general criteria identified in the Chairman's remarks at the Pre-Hearing Conference on October 7, 1981, which remarks are annexed hereto as annexure "A" to this Order. Each application for costs will be considered on the basis of the intervenor's participation in the particular Phase in respect of which costs are sought. All participants are advised that each application for costs will be examined on its own merits and the Commission makes no commitment that an award will be made in any individual case.

DATED at the City of Fort St. John, in the Province of British Columbia, this 7th day of October, 1981.

BY ORDER

Chairman,
Site C Division.

Attchs.

ANNEXURE A

PROCEEDINGS AT PRE-HEARING CONFERENCE
PAGE 125 LINE 7 TO PAGE 127 LINE 21

This panel considers that certain costs of intervenors are a legitimate expenditure for the purpose of making certain that all aspects of the effects of the works proposed in the application are adequately examined, and some costs will be awarded to those intervenors whose submissions have been significant to the hearing process. They will be awarded after the hearings are complete.

A significant criterion that will be used in the determination of cost awards, aside from need, will be the degree to which the intervention contributes to the understanding of the issues raised by the application. The panel wishes to make it clear that it is very likely that only a portion of an intervenor's costs will be funded.

All participants are hereby expressly informed that each application for costs will be examined on its merits and makes no commitment that an award will be made in any individual case.

The following guidelines are offered: travel costs may be paid where the Commission deems they're justified, but will be limited to economical common carriers or automobile mileage. The Commission points out that the hearings are being held in several places to reduce travel requirements for participants. A daily allowance of $60.00 may be paid for meals, accommodation and incidental expenses for participants whose attendance is deemed to be justified at hearings to which they must travel.

The Commission will evaluate the contribution made by intervenors to the Commission's review process for Site C and will consider this in awarding costs. Repetition of previously introduced information will receive a low evaluation. Participants are therefore encouraged to co-operate in presentation of evidence. Costs of hiring counsel and researchers may be awarded by the Commission.

Applications for costs must include detailed breakdowns of personnel time used, identifying tasks performed. Travel and expense costs must also be set out in detail.

In special cases where individual personal appearances are deemed to be of significant contribution, the Commission may judge time lost -- I'm sorry. Commission may judge lost income to be a cost.

In summary the panel points out that the award of costs will be made after the hearings and the amount of the award, if any, will be at the discretion of the panel. The criterion for consideration will be the usefulness of the intervention and the degree to which the intervention contributed to the hearing of the application. The panel will hear argument at the end of the hearings on the matter of the award of costs.

Finally, the Commission recognizes that the applicant is a utility owned by the people of the Province of British Columbia, which is provided and will continue to provide an essential service to its owners. It is further recognized that this Commission's review represents a real cost to the applicant, both direct and indirect. Frivolous, irresponsible or mischievous attempts to delay these proceedings will increase these costs to the people of British Columbia who must ultimately pay them. Participants are reminded that this Commission has the responsibility of determining to whom and by whom costs are to be paid.

ANNEX B

SUPPLEMENTAL GUIDELINES FOR COST APPLICATIONS

READ INTO THE RECORD APRIL 20, 1982

PAGES 8,362 AND 8,363

THE CHAIRMAN: Thank you. I'd like to read the results of a meeting that the Commission held last week, with respect to the costs.

The Commission has received a number of cost applications with respect to Phase1 and 2 of the hearing. It has also received submissions from B.C. Hydro with respect to certain of these applications.

The issues raised by the actual cost applications and the Commission's subsequent deliberations on these issues has allowed the Commission to develop some more detailed guidelines with respect to cost applications in general. These guidelines are designed to supplement, and not supplant, the guidelines contained in Commission Order Number G-74-81, dated October 7, 1981.

General philosophy government cost decisions will remain as expressed in Order Number G-74-81. The guidelines are designed to give the parties an indication of the Commission's thinking, and to serve as the guide which will govern in any exceptional cases. Copies of the guidelines have been made, and are available on the side table for any party who wishes to see them.

The Commission also wishes to change the procedures which have evolved with respect to cost applications. In future, applicants are directed to forward copies of their application to the Commission and to the party against which the award is sought. If the party against whom the award is sought wishes to respond, it may do so by serving the Commission and the cost applicant with its response in writing within 10 days of receiving the application.

The cost applicant may rebutt this response by serving the Commission and the party against whom the award is sought with its written rebuttal within 5 days of receipt of the response.

On receipt of the cost application, the response and the rebuttal, if any, the Commission will issue an order indicating the disposition of the cost application. The Commission's order will be final.

The guidelines referred to are in supply on the table over there.

ANNEX C

GUIDELINES FOR COST APPLICATIONS

The following guidelines will apply to cost applications which fulfill the general criteria outlined in Commission Order No. G-74-81 and to which exceptional circumstances do not apply:

A. Fees paid to outside Consultants

1) Lawyers: Costs payable to a maximum hourly rate of $75.00 per hour or $600 per day, whichever is the lesser, depending upon experience, skill and significance of contribution to the hearing.

2) Researchers: Costs payable to a maximum hourly rate of $15.00 an hour or $120 per day, whichever is the lesser, except where special skills or qualifications are demonstrated to have been brought to bear. The amount allowed will vary from case to case dependent upon the researcher's qualifications, experience, skill and significance of his/her contribution to the hearing.

3) Witnesses: Witnesses will be paid on the same scale as researchers.

B. Subject Matter of Claim

The following items will not be allowed in cost awards:

1. Time spent in preparation of cost application.
2. Time spent in connection with general matters not directly connected with the Phase of the Hearing for which the claim is made.
3. Time in excess of the cost of travel time and travel expense associated with the method of travel which would have minimized the total cost of that travel.

C. Payment to Intervenors

Except in special cases, payment will not be made in respect of time spent by intervenors themselves. Accordingly, claims in respect of the time of individual intervenors or of employees of intervenors will not be allowed.